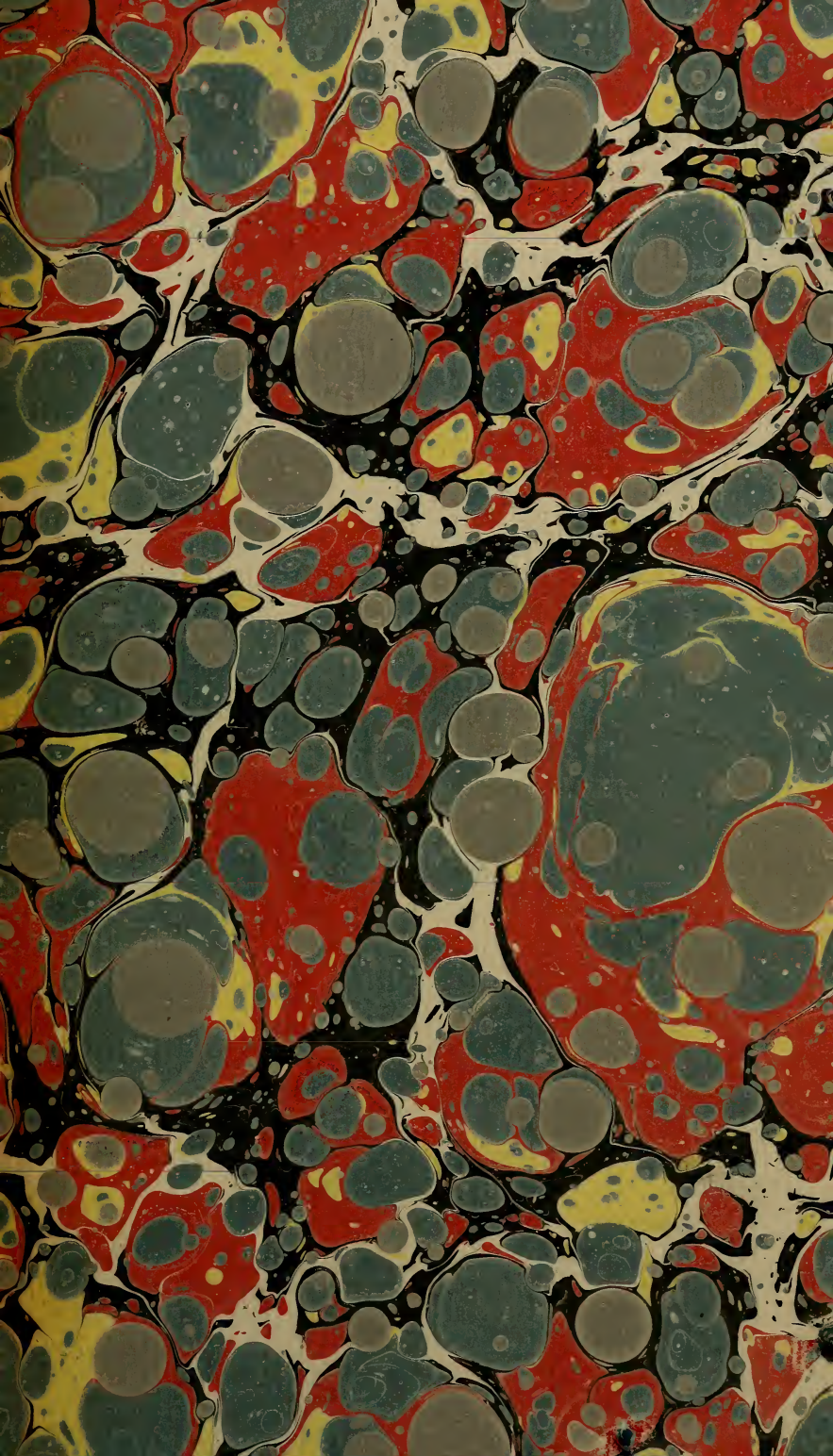

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3. Massachusetts society for promoting agriculture. Papers on agriculture, 1803.

4. Same. Papers on agriculture. 1799.

5. Johnson, A.B. An address to the Utica Lyceum, Feb. 17, 1825.

6. Colman, Henry. An address before the Massachusetts agricultural society, Oct. 17th, 1821.

REPORT

OF

THE COMMISSIONERS

OF THE

STATE OF MASSACHUSETTS,

ON THE

ROUTES OF CANALS FROM BOSTON HARBOUR,

TO

CONNECTICUT AND HUDSON RIVERS.

BOSTON:
TRUE AND GREENE, STATE PRINTERS.
1826.

ADAMS 290.1c

MESSAGE.

To the Honourable the Senate, and
House of Representatives.

I hasten to transmit the Report of the Board of Commissioners, for the survey of a Canal Route, from the harbour of Boston to the Connecticut River, with the Reports, Plans, and estimates of the Engineer, together with an accompanying Map of the State, on which are delineated the various routes which have been surveyed.

These documents are so voluminous, that copies, in duplicate, for the separate use of each branch of the Legislature, would be attended with much expense, and so great delay, as to defeat the object of their communication, the present session. I therefore have directed the Secretary to ask permission to lay the original upon the table of the Honourable Senate.

LEVI LINCOLN.

Council Chamber, January 11, 1826.

Commonwealth of Massachusetts.

In Senate, January 11, 1826.

Ordered, that one thousand copies of the Message, and the Report therein referred to, be printed for the use of the members.

Attest, PAUL WILLARD, *Clerk.*

In Senate, 13*th January, A. D.* 1826.

Ordered, that the Clerk of the Senate be authorized and directed to procure the printing of the Report of the Commissioners, appointed to survey a route for a Canal, from Boston Harbour to Connecticut River, which was yesterday ordered by this Board, to be done under the direction of said Commissioners; and that he also procure one thousand copies of the plan, accompanying said Report, to be struck off, under the direction of the Engineer, who drew the same.

REPORT.

To the Honorable the Senate, and the House of Representatives, of the Commonwealth of Massachusetts.

The Commissioners appointed, in conformity to the Resolutions passed on the twenty-fifth day of February, 1825, "to ascertain the practicability of making a Canal from Boston Harbour to Connecticut River," and "of extending the same to some point on the Hudson River, in the State of New York, in the vicinity of the junction of the Erie Canal with that River," respectfully Report:

That, on the eighth of July, accompanied by Col. Loammi Baldwin, the Engineer, they commenced the reconnoisance of the various routes, which, were deemed practicable; and as it was not only highly important, but their duty to make such explorations, as would enable them to obtain the desired preliminary information, on all the possible lines of connexion, it became necessary to traverse four entire routes, to the summit range of high land between Boston Harbour and Connecticut River, two from thence to the Connecticut, the same number to the Hudson, as well as several lateral devia-

tions, on each line ;—and they will first present the results of their researches, in the order in which the reconnoisances were made, between Boston Harbour and Connecticut River.

RECONNOISANCES.

WESTMINSTER AND BOLTON ROUTE.

Commencing above the upper factory dam, in Waltham, the line of canal extends up the left bank of Charles River to the mouth of Stony Brook, over low, level, and very favourable land for excavation ; thence up the basin of Stony Brook to a valley, which opens into it, twenty or thirty rods below Bigelow's mills, and offers a more eligible route than to follow the course of the stream, which for some distance, above and below the mills, passing through high ledges, it has a fall of over twenty feet, with rugged and precipitous banks, in which it will be difficult and expensive to lay the bed of a canal. In the course of the line through this valley, which is a mile in extent, are two small ridges, between wet meadows, which will require cuts of some ten or fifteen feet deep, and from five to ten rods in length. Thence, pursuing the vale of Stony Brook, the assent is gradual, for four or five miles, to the summit level, through several meadows and intervals, generally narrow, but occasionally spreading out, to from ten to twenty rods, in width ; the hills, on either side, being low, their declivities are gradual, and are composed of gravel, interspersed with large stones. and, occasionally, ledges appear.

The summit level between Charles and Concord Rivers, is in a very moist meadow or bog, from which the fall to tide water is 160 or 170 feet, and to Concord river forty or fifty.

The line of Canal, from the summit, is down the valley of Cutting's Brook, which passes through bogs and meadows, with a gradual descent, except at a point, within three quarters of a mile of the summit, where there is a fall of ten or fifteen feet, in the distance of twenty or thirty rods.

As the meadows are very wide on Concord River, and would require long and high embankments, besides an expensive aqueduct to cross them,—opposite the mouth of Cutting's Brook, the line is deflected, from near the bridge, which crosses it, on the road to Boston, up the right bank of Concord River, to a point, a mile or less below the Framingham factory, where either a dam can be made for crossing, and converting the river into a feeder ; or, in the event such a structure should be found to interfere with the hydraulick privileges, above or below, it will be easy to substitute an aqueduct, as the high banks approach so near the margin of the river, as not to require one of great length, or more than fifteen or twenty feet high. The distance from Boston to this point is between 21 and 22 miles.

Besides the water of Concord River, Palm, or Farm, Larned's, Gleason, Shakum, Sucker, Dug and Long Ponds, situated in Framingham, east of the river, may all be converted into enlarged reservoirs, for supplying the canal ; and they now include an estimated area of nearly three thousand acres. The waters of these ponds, do, or can, at little expense, be made, to flow into the river, above the canal route.

After crossing the river, the line continues along the left bank, to Lannum Brook, and up the valley

of that brook to Willis' Pond. The summit level between Concord main, and its northern branch, or Stow River, sometimes called the Elsibeth, or Elizabeth, is thirty rods east of Willis' Pond, and only six or eight feet above its surface, and between thirty and forty feet above Lannum Brook.

The route passes round the northeastern side of Willis' Pond, and that of Puffer's, distant one mile.

Willis' Pond has an area of three hundred, and Puffer's of fifty acres. The outlet from the former into the latter, flows, sluggishly, through swamps and meadows; and a dam, ten or twelve feet in height, and one hundred and fifty yards long, across the outlet of Puffer's Pond, would cause the water to flow back into Willis' and raise it five or six feet, which would extend the area of the surface of both ponds, to nearly six hundred acres;—and this can be done, without injuring, but a small quantity of valuable land, the remainder being a worthless swamp.

The line of canal continues down the valley of the outlet of Puffer's Pond, to Stow River, which it enters, half a mile below the mouth of Stow Brook, or the little Elizabeth, passing sometimes through meadows of considerable extent; but for a large portion of the distance, the valley is so contracted, as to leave only small margins of interval land; and occasionally the gently sloping banks reach the stream. From the point where the line crosses Concord River to Stow River, distance seven miles, the soil is sandy loam, and coarse gravel, with some few scattered rocks, without a single ledge, except at the eastern end,—offering favourable ground for excavation, and not requiring much embankment, or extra cutting, except a few rods, five or eight feet deep, near the eastern end of Willis' Pond. This, however, will depend upon the height of the aqueduct over Stow River.

To supply this section of the canal, besides Willis' and Puffer's, are White and Bottomless ponds. White Pond is a mile south of Willis',—has an area of three or four hundred acres, and is very deep: Bottomless Pond is half a mile west of White Pond,—has a surface of twenty acres, and is also deep. The two latter ponds, being higher than Willis', may be connected with it, very easily, and will afford a great prism of water.

To cross Stow River will require an aqueduct and embankments, forty or fifty feet high, and five or six hundred feet in length; or a dam of that elevation and extent; and if the latter is adopted, not only the water of the river, and Stow Brook, with their tributary streams, but several ponds in Berlin, Marlborough and Northborough, may be converted into reservoirs, to supply the canal, towards Boston; which is very desirable, if the water of Concord river is lost, by being compelled to cross it, on an aqueduct.

Proceeding up the basin of Stow Brook, to the confluence of its two branches, near the eastern bounds of Bolton, the line of canal extends, thence, through the valley of the south-western branch, to the base of Bolton Hill, east of the meeting-house; or it may be preferable to pass through a valley, for half a mile, north of Spindle Hill, which appears to offer a practicable route, and will be a mile and a half shorter, than to continue on the bank of the stream, which makes a great detour, round the south and eastern side of Spindle Hill.

To cross the great ridge, in Bolton, and the deep valley of Nashua river, to the highland in Lancaster, it was found, after a careful reconnoisance, that very formidable obstacles were to be encountered; and that their extent might be accurately ascertained, the Engineer was directed to run a trial

level, from the eastern base of the hill, to the borders of Leominster; the following extracts from his reports, contain the results of his survey.

Bolton, August 28, 1825.

Dear Sir,—I began on the ridge, and proceeding eastward, crossing the turnpike, and descended down the low ground, near Mr. Wilder's fish-pond, down the valley by Morse's mill, keeping to the west of Mr. Cleaveland's house, and came up on the river a few rods below Carter's mill, where the best place for crossing the Nashua seemed to present itself. The distance from the summit to the river, as I surveyed it, is 3.807 miles. Not knowing beforehand, what level could be carried over the valley of the stream, I took such a course, as enabled me to judge, as I went along, how a lower or higher level might be laid; and I am satisfied no difficulties will be found between the ridge and the river. The summit point is 214.19 feet above the surface of the Nashua, just below Carter's mill; and finding it probable, that a level, 50 feet above the river, might be accomplished, I assumed that level, and prosecuted the remainder of the line accordingly.

Leaving the river, I carried the level across the high ground, near New Boston, and then passed a deep and wide hollow, over to the stopping side hill, called George Hill, forming the right bank of the Leominster branch of the Nashua river. We passed near the Pennikin mills, and found the pond 33.07 feet below level.

Last night I stopped, at dark, on the west side of the meadows, at the mouth of Wickipakick stream, where the level is nine feet above the meadow, at a distance of 5.470 miles from Carter's mills.

The route westward, from the Nashua, at Carter's mills, is extremely favourable, though circuitous, except the hollow, which must be passed, on a different line, from that I went upon; but I have not had time to run a new line of that part. As there can be no doubt of the canal being practicable above where I stopped, at the Wickipakick, I shall not, at present, extend the survey further, up the Nashua towards Leominster, unless the Commissioners otherwise direct. I presume their present object will be obtained upon this point, by what I have now said.

The distance across the Nashua, between banking, at 5 or 6 feet depth, on each side, will be about 95 rods. This distance includes the river, 97 links wide, and the meadows and bottom-land, generally 40 or 45 below level. An aqueduct of 3 or 4 arches, and some high embankments will be necessary here; but such as are frequently to be encountered on canals. The level from Carter's mill, enters the ground about Morse's mill, which we viewed with Gen. Holman, Mr. Stedman, and by driving up the heading for a tunnel, to 30 or 35 feet cutting, a tunnel becomes indispensible at 164.19 feet below the summit, from which place to the western end, following the surveyed line, it will be 98 chains, or nearly one mile and a quarter. By a straight course it would, probably, be reduced to within one mile. But how far the tunnel must extend, eastward, I shall ascertain tomorrow, and let you know the result as early as possible.

Assumed level to cross the Nashua, just above the river,	50.
Summit point,	164.19
Above level,	
Total height of ridge,	214.19

Above the water of the Nashua, below, but near Carter's mills.

I am fully aware, how difficult it is to make any description intelligible, without the aid of a profile, and I should certainly give you one, as you have suggested, if I had time to prepare it; but I assure you, I have been so constantly occupied with the surveys, that I have not had time even to begin one. I shall, however, cheerfully comply with your request, if you still wish it. In that case, I should prefer going over the lines again, in part, to procure some more precise positions of the level, which would occupy me a day or more.

Upon the whole, there are only three difficulties, which I should consider such, within the 9¼ miles I have surveyed; viz.: the *Hollow*, Northwest of New Boston; the *Nashua River*, and the *Bolton Ridge*. Some considerable embankments will also be required across the meadows of the Wickipakick, but it will be reduced considerably by going near the road, and crossing higher up, than where I surveyed; though the expediency of this may be doubted.

I have thus given a general description of the only line, I have tried, and I am convinced, from what I have seen, that this is practicable, and that to cross the river at a lower point, is inexpedient, or even impracticable.

I hope the Commissioners will find this statement satisfactory, and I beg you to present my respects, and assure them, I shall be happy to have their further instructions, if they wish for fuller information upon these preliminary points.

I shall proceed, tomorrow, with the level from the summit, eastward, until our assumed level comes out, and after giving you the result, go to Westminster, to assume the labours of the main survey, unless otherwise directed.

I remain, with great regard,

Your obedient servant,

L. BALDWIN.

Gen. H. A. S. DEARBORN.

Bolton, August 30, 1825.

Dear Sir,—Yesterday I took the levels eastward, from the summit of *Bolton Ridge*, and carried the survey down the valley of the brook, 4.125 miles, towards Stow, and left off at a point 38.27 feet *below* level, that is, 11.73 above the Nashua, at Carter's, and 202.46 feet below the summit. The assumed level, of 50 feet above the river, comes out at the north side of the great road, near Hildreth's Tavern, by the brook, at 3.201 miles from the summit, and by opening a heading to about 35 feet depth of cutting, the distance will be reduced to 2.551 miles, or about 2½ miles. These distances are upon the surveyed line ; but if a tunnel is opened, it will be made straight between the eastern and western ends, and, of course, the length greatly reduced, from the distance given by the survey. The result of the whole survey of the ridge, leads to the conclusion, that a tunnel, upon, the level assumed, must be, at least, about two miles and a half long.

Upon these facts, I think it important that another attempt should be made for crossing the Nashua at Carter's mill, upon a higher level, say 70 or 80 feet, or by seeking more favourable ground, further up that river, although a more circuitous route will be necessary.

The exact length of the tunnel cannot be ascertained, until the surveyed line is plotted; but I presume the Commissioners will neither wish for a plan, nor for further trials here, at present. I shall, however, on my return from the survey to the Connecticut, examine and survey the ground bordering on the Nashua, both to perfect my present lines and to discover, if possible, a bet-

ter mode, or better place for crossing the valley of the Nashua.

With great respect and esteem,

Your obedient Servant,

L. BALDWIN.

Gen. H. A. S. DEARBORN.

It being important to avoid more than one summit level, between the Connecticut and Boston Harbour, to prevent the loss of water, which would necessarily be the case, between the summits; and to diminish the expense and the delay, to the passage of boats, which the consequent increase of lockage would occasion, it is not improbable, that a tunnel and lofty aqueduct or dam, is not the preferable mode, of passing Bolton Hill and the Nashua. But if a second summit level is assumed, there, possibly, may be sufficient water brought on to it, to supply the lockage. The Washakum Ponds in Sterling are estimated, by the gentlemen who live in their vicinity, to be higher than Bolton Hill, from which they are distant six miles. The largest has an area of three hundred, and the other of two hundred acres; and by erecting a dam across the outlet of the smaller pond, which can be done for a few hundred dollars,—as it is narrow with high banks,—both ponds can be flowed six or eight feet, and thus vastly increase their prisms of water; but the deep valley of the Nashua intervening, the feeder must either be circuitous, long and expensive, or the water conveyed in iron pipes, as may be that of the Nashua river, in the same manner, if a reservoir is made, by throwing a dam across it, at a point higher than the Bolton summit level. It is presumed, that both

these resources must be resorted to, to insure a sufficiency of water; and perhaps even others must be sought, to completely supply the demand of a great traffic upon the canal. But if the Nashua is passed by a dam, and Bolton Hill is pierced by a tunnel, the water of the river and the Washakum Ponds may be made tributary to the whole line of canal to Boston, while half of their volumes would be lost, by a lockage down the western declivity of Bolton Hill, which, together with that from the crown summit level, must run waste into the Nashua.

The expense of constructing locks, forming reservoirs and cutting feeders to supply them, would amount to nearly, or quite as much as a tunnel, and they would impede the passage of boats several hours longer.

About two miles east of the meeting-house in Bolton, and north of the canal route, but immediately upon it, are inexhaustible quarries of primitive lime-stone. They have been wrought for many years, and two kilns, which are in operation, produce, annually, fourteen hundred casks, containing eleven bushels each, of the very first quality of lime; said to be superiour to that made at Thomastown, in the State of Maine.

From the western end of Col. Baldwin's survey, at Wickipakick stream, the route of the canal extends along the right bank of the Nashua, but receding gradually from it, to Leominster meeting-house.

Wickipakick Brook falls into the north branch of the Nashua, five miles from its confluence with the south branch. It may be flowed by a dam, south of the road, from Lancaster to Leominster, and an extensive reservoir thus formed, as it is a perennial stream, affording a great quantity of water, in the dryest seasons.

Wannoosnick stream has its source in a swamp, at the base of Wannoosnick mountain, and running south, through part of Leominster, turns to the north-east, thirty rods south-east of the meeting-house, and falls into the north branch of the Nashua, eight miles from its mouth. It is a large stream, having several mills and manufactories upon it.

In the northern part of Lancaster, between four and five miles north-easterly from Leominster village, is Spectacle Pond, which is, at least, one hundred feet above the Nashua, and its outlet falls into the north branch of that river, a few rods from the confluence of the Wickipakick Brook. This pond is very deep, has an area of between three and four hundred acres, and may be converted into a most valuable reservoir, as it affords an abundant supply of water, at all seasons of the year, and may be considerably increased, by a dam, at a small expense.

About twenty rods south of the meeting-house in Leominster, two routes are presented, over the summit level, of Ashburnham and Westminster: One, passing east of the meeting-house, and approaching the Nashua, near the north-west bounds of Leominster, continues up the left bank of that river, through Fitchburg, to the south side of great Naukeage Pond in Ashburnham.

From Wickipakick Brook, to Leominster meeting-house, the line is not difficult, and from thence to Fitchburgh, seven miles, the land is favourable for the purposes of a canal, the ascent being only thirty-eight feet.

Fitchburgh is a flourishing village, and has grown up within fifteen years, in consequence of the establishment of various kinds of manufactories; and from the numerous hydraulic privileges,

which the rapid descent and abundant water of the Nashua affords, it is destined to be a place of great business. There are now three cotton factories, containing twelve hundred and thirty-six spindles, and looms sufficient for weaving 104,000 yards of cloth annually; two woollen factories, which consume 60,000 pounds of wool;—a sattinett factory; two tan-yards;—five saw, and two grist mills;—pot-ash works;—and a window-blind manufactory, in which 4,000 are annually made and sent to Boston. There are numerous quarries of excellent granite in Fitchburg. Rollstone Mountain, situated on the right bank of the Nashua, opposite the village, having a base of three-fourths of a mile, and an elevation of 300 feet, is one entire mass of granite, and being disposed in strata is easily wrought.

From Fitchburg to the summit level in Ashburnham, and from thence to Connecticut River, the hydrographical and topographical, and other details, are contained in the Engineer's Report, which renders it unnecessary to give the results of the reconnoisance on that portion of the line.

The route through Westminster continues north, from Leominster meeting-house, near which it crosses Wanoosnick Brook, and again intersecting it, in the borders of Fitchburg; thence it turns to the west, and passes through that town, up the valley of the brook, to a swamp, east of the outlet of Wachusett and Westminster Ponds; thence south of that stream, to the eastern line of Westminster, and there crossing it, enters a valley which extends, north of the meeting-house, in that town, to Tophet Swamp; distance ten miles.

The land is unfavourable from where the line intersects the valley of Wanoosnick Brook, which has a precipitous descent and tortuous course, over

ledges and through steep and rocky hills, rendering it difficult and expensive to construct a canal; and the remainder of the line is over rugged hills and vallies, all requiring numerous excavations, of extra depths, high embankments and large culverts.

A pond, a quarter of a mile south of Westminster meeting-house, and Wachusett Pond, near the base of the lofty mountain of that name, may be converted into reservoirs to supply the canal, as their united outlets cross its line as above stated. The area and prism of water of the former are given in the Engineer's report; the latter has an estimated area of 140 acres.

One mile and a half west of the meeting-house, near the turnpike, is the summit of the mountain range, between the Connecticut River and Boston Harbour, on this line, which passing on the southern side of Tophet Swamp, for three miles, and near the turnpike, to the outlet of Gardner Pond, and thence through a vale, reaches Otter River above Sawyer's mills, which are four miles and a half from its mouth;—thence down the valley of that river to Miller's River. The distance from the eastern end of the valley, which the route enters, from Bolton, north of Westminster meeting-house, is $13\frac{1}{4}$ miles, and the fall $265\frac{84}{100}$ feet, as ascertained by the Engineer, who reports:

"To extend the summit level westward from Westminster, will require a deep cut of between 30 and 40 feet at the west end; but nothing seems very forbidding, and I think it can easily be effected. From the west end of the summit level, I find no difficulty in making the Canal; it is in my opinion perfectly practicable. Crossing the Otter or Miller's River occasionally, either by dams or aqueducts, will be of little moment, to take advantage of the best ground; and the Otter River may

be turned, and a new channel cut, in several places to shorten the distance. In one or two places, a much shorter route, I am told, very favourable too, may be obtained, different from the route I generally pursued along the valley of the river. But I did not think it best to spend time now, to find the best of all possible lines, as much time would be required. I have seen enough, to learn, that in the distance of more than twenty three miles, from Westminster, a canal is easily to be effected."

"I stopped last night about half a mile below the Athol factory, which, you will recollect, is about three quarters of a mile below Kendall's mills.

The falls from point to point, along the line surveyed, are as follows :—

	FEET.	TOTAL.
Fall from east end of *Tophet Swamp*, to head of meadow below Greenwood's house and Lathe Machine near the Turnpike	26.67	
Thence to surface of water at Clark's new mill, by the Turnpike	4.43	31.10
Thence to Col. Williams' mill-pond, near Whitney's Tavern	9.80	40.90
Thence to Meriam's mill-pond, below the turnpike and Bickford's mills	33.96	74.86
Thence to Gardiner Pond Brook, on the left of the Turnpike	43.76	118.62
Thence, crossing the Turnpike, by Tucker's, to Otter River	49.18	167.80
Thence to Sawyer's mill-pond	4.83	172.63
Thence to Stone's mill-pond	17.83	190.46
Thence to Deadman's do.	10.78	201.24
Thence to Baldwin's do.	32.55	233.79

Thence to Flagg's Bridge, above the junction of the rivers, near Wales' Tavern	31.16	264.95
Thence to junction of Otter and Miller's Rivers	.89	265.84"

To supply the lockage over the summit level of Westminster, besides, the water which Tophet Swamp may be made to afford, by damming up its outlets, the great Naukeag Pond, in Ashburnham, must be made the chief reservoir, and the water conveyed in a feeder, nine miles in length, over a very difficult route, as will appear from the following report of a trial level, run by the Engineer.

Ashburnham, September 25, 1825.

Dear Sir,—I thank you for your obliging letter of the 21st inst. which I received last evening.

I came here last Tuesday, and in the afternoon began the survey from Naukeag Pond, across the country, to connect with the Westminster line. Owing to the rain, however, I could only begin. Wednesday, Thursday, and Friday, I completed it; the whole distance measured, being nearly nine miles.

The result of the survey shews that pond to be 47.06 above the Tophet Swamp; or what I call the Westminster level. This had been represented as about 51 or 52 feet above the swamp; but I believe my level may be relied upon as correct. From the thick woods and swamps, which extend through the country, between these points, it was almost impossible to find a good line for the survey, without exploring the country a long while; nor could a course, for cutting a feeder be determined, without such a trial survey, as I have made,

being previously obtained. The line I went upon will not answer, but the survey will exhibit the highest points and ridges, which must necessarily be crossed, as well as the low ground and swamps, which must be avoided, as they lie much below the practicable level for crossing the ridges ; and in some places, below the Tophet Swamp. I presume, that on further trials a feeder will be found practicable, although the ground is very uneven in many places, and, except the swamps and meadows, full of rocks.

With great respect and esteem,
Your obedient servant,
L. BALDWIN.

Gen. H. A. S. DEARBORN,
Canal Commissioner.

Near and below the western end of the level, through Westminster, several streams may be increased, by flowing swamps south and north of the line, and brought into the canal ; also the water of Gardiner Pond, which has an area of 139 acres, while the tributaries of, and Otter River, will supply it to Miller's River.

From the confluence of Miller's and Otter Rivers the route is down the valley of the former to the Connecticut, which having been accurately surveyed by the Engineer, it is unnecessary to give the results of the preliminary explorations, on that portion of the line of canal, as his able report and excellent plans contain all the requisite information, in a more detailed, exact and satisfactory manner, than it was possible to accomplish, by a mere reconnoisance.

SOUTHERN, OR SPRINGFIELD AND WORCESTER ROUTE.

The Chickapee River enters the Connecticut, two miles and a half above the village of Springfield. Half a mile from its mouth are rapids, which extend for a third of a mile, in which distance there is a fall of thirty feet. Two miles above are the falls, where are situated the Boston and Springfield cotton factories. The uppermost fall is ten feet perpendicular; one hundred yards below, is a second, of four feet; and from thence, within a few rods, there is a descent of nine feet, making the whole fall, to Connecticut River, at least 55 feet. The ledges, which constitute these cataracts, are formed of horizontal strata of slate stone, and at the highest fall this singular formation stretches across the river, which is one hundred yards wide, in a straight and continued line, forming a perfect natural dam,—above which, the river is tapped and the water conveyed, in an artificial channel, along the left bank, to the factories, situated on a plain, below the foot of the falls, round which the river makes a flexure to the north.

This thrifty establishment was commenced, but little more than two years since, and there have already been erected two large brick factories, five stories high, containing seven thousand spindles and two hundred and forty looms;—eighteen brick and two wooden edifices, chiefly intended as dwelling houses, and affording tenements for fifty four families.

This village cannot fail to extend into a rich and populous town, for the Chickapee affords such an abundant and constant supply of water, that there was sufficient that run to waste, over the dam, in

July, for propelling more than one hundred water wheels, of the size of the two, which move all the machinery of that extensive establishment. There are few, if any, more valuable hydraulick privileges in the Commonwealth, and the proprietors evince a spirit and enterprise, which will speedily convert all its power, to the great purposes of giving motion to numerous manufactories.

A canal can be constructed from this village, to enter the Connecticut, through the village of Springfield, by extending it over a plain of sand and gravel of easy excavation. This will ultimately be done, by the manufacturing company, to facilitate the transportation, between their Works and Springfield Landing.

Eight miles above are the falls, on which is situated the Springfield factory, in the town of Ludlow. Here the river is contracted between high banks, of red sand-stone, and the descent to the lower factory is fifty six feet. Two miles south are quarries of free-stone, of which the factory is built; it is easily wrought and would furnish excellent materials for locks, culverts, abutments for bridges, walls and other works on a canal.

Instead of the line of canal passing down, on the immediate bank of the Chickapee, either to its mouth, or as far as the Boston and Springfield Factory, and thence turning off, over a plain as has been suggested, to the village of Springfield, and there debouche into the Connecticut, it may be found most expedient to tap the river three or four miles above the factory, in Ludlow, where a dam fifteen feet high can be erected, and the canal carried along the more elevated part of the river bank, to a point, near where the road from Ludlow village intersects that from Springfield to Boston; and thence down the valley of Mill River,

which enters the Connecticut a mile above the southern boundary line of the town of Springfield; or that of Garden Brook, which runs north of the United States' Armory, and passing through the northern part of the village of Springfield, enter the river, above or below the bridge.

There is no doubt, but either of the routes, which have been named, are practicable, the land being a plain, composed of sand and gravel, resting upon strata of slate and red sand stone, which are so deep, however, that the excavations will not probably reach them, on any part of the line, except near the second falls, in the event the line should be extended in that direction.

The southern, or chief branch of Mill River, has its source in Somers, and joins the northern branch, four miles above the upper United States' Armory dam. This stream affords sufficient water, all the year, for several mills in Wilbraham, and a forge, furnace, a large paper, a saw and two grist mills, one of them having five run of stones, and four machine shops, on as many dams belonging to the Armory, situated in the town of Springfield;—but the Chickapee River will amply supply the canal, from its junction with Ware River.

From the point, where it has been proposed to throw a dam across the Chickapee, the canal line continues up the left bank of the river, to the "Elbow" or "Great Bend," which, commencing in Palmer, extends north and then round to the south, making a circuit of nearly three miles, while the distance in a direct line is less than two. The route will cross a portion of the Elbow, to a point above the mouth of Ware River.

A few rods west of the turnpike gate, distant twelve miles and a half from Springfield, Twelve-Mile Brook enters the Chickapee. It passes

through a part of Monson and Wilbraham, and affords water sufficient for several mills.

Some portion of the route, from the point where a dam has been projected, to near Sedgwick's house, will be difficult and expensive, the banks of the river being steep and rocky; in crossing through the Elbow, ledges and large rocks will be encountered; and it may be necessary to pass the river by an aqueduct, once or twice, before reaching the bridge, in the upper part of Palmer.

Immediately below the confluence of Chickapee and Ware Rivers, distant fifteen or sixteen miles from the mouth of the former, is a rapid, which, within one hundred and fifty rods, has a descent of twenty five feet; and the whole fall to the Connecticut must be 150 or 160 feet. This invaluable water privilege has been recently purchased, by the gentlemen interested in the Ware Factories, and they have commenced the erection of one of the most extensive manufactories of woollen cloths, in this country.

In Palmer, it is possible to shorten the canal line, very considerably, by crossing a great bend in the river, near Sedgwick's house. From thence to the bridge, on the road from Palmer to Brimfield, six miles from the mouth of Ware River, the Chickapee has a very gradual descent, and the banks offer remarkably favourable land for laying the bed of a canal.

From the bridge, a mile above the one last named, to "Western City," the river is sinuous and rapid, with many falls, as Coy's Hill on the right bank, and a like elevated and rugged range on the left, rise, precipitously, immediately from its shores and compress it into a narrow and rocky channel. The acclivities of these hills are so steep, and rendered so rough, by projecting ledges and huge

masses of porphyritic granite, that it will be necessary to run the canal, past these obstacles, on an embankment, supported by walls of masonry, or lay it along a shelf, cut in the slopes of the hills, for two or three miles.

The fall from the mill dam, near the road, in Western City, to the junction with Ware River, must be nearly two hundred feet; but from the same point to Quabog Pond, in West-Brookfield, distance between four and five miles, the current of the river is quite tranquil, there being neither falls or rapids, and the descent trifling and gradual. The alluvial margins of interval are too low for the bed of a canal, but the ground that descends to them, being sand, and diluvial pebbles, the excavations can be executed without difficulty, but may require to be lined with puddle.

Coy's Hill affords abundance of granite, for locks and the other stone-work of a canal. At the base of the hill, near the river, a mile from Western City, iron ore is found, and a mineral spring has been opened, which has some visitants.

The outlet of Quabog Pond crosses the road, a mile west of the meeting-house, in the West parish of Brookfield, and does not extend more than 100 rods, before it enters the Chickapee. The pond has an area of three or four hundred acres, and is so little elevated, above the river, that the latter flows into the pond, through the outlet, during the spring freshes.

The canal line, from near the outlet of Quabog Pond, passes round the southern base of the hill, south east of the meeting-house, along the low land north of the river; thence through a valley south of the Rev. Mr. Stone's dwelling house, and round the base of the hill, which extends south of the meeting-house, in the East Parish of Brookfield,

to near the western end of Great Podunk Pond, from which the Chickapee issues :—thence near the road, over level and generally meadow land, to a point, a few rods below Gallup's Mills, on Seven-Mile River, and up the basin of that river, to the bridge, one mile west of Spencer meeting-house, and twelve miles from the mill-dam in Western City. There is not a fall from Gallup's Mills to the outlet of Quabog Pond, and the route favourable, requiring, perhaps, a little extra cutting, and some embankments, but of not a great elevation.

Gallup's mill-dam, where there is a fall of eight or ten feet, is half a mile below Spencer Bridge, two hundred rods above the junction of Seven and Five-Mile Rivers, and two miles north easterly from Great Podunk Pond.

A mile north of Great Podunk Pond, are Perry's two ponds, which have an area of 50 acres. Their united waters form Hepsey's mill-pond, by a dam across the outlet of the largest, which falls into the Chickapee, near its source, in Podunk Pond.

Five-Mile River passes through a swamp and meadow, of a thousand acres, which could be flowed and converted into a reservoir, by a dam only four or five rods long, just above the road leading to Spencer.

Great Podunk Pond is in Brookfield, and has an area of 900 acres; and the southern Podunk Pond, extending into Sturbridge, has a surface of 300 acres. There is a communication between them, but being so nearly on a level, there is no rapid, and in the spring, when the accumulated and united waters of Five and Seven-Mile Rivers rush into the Great Pond, it sets back into the smaller one; the remainder of the year, the water of the South Pond, flows languidly into the larger one.

There are numerous beds of iron ore in the bogs and meadows of Brookfield, and many tons are annually sent to the Stafford, Hardwick, and other furnaces, chiefly for castings.

After completing the reconnoisance of the remainder of this route, which includes the summit level, between the Connecticut and Boston Harbour, being of opinion that it would, probably, require a tunnel, extensive embankments, several deep cuts, and numerous locks, to pass the lofty hills and deep vallies of Spencer and Leicester; while the ridge between the Blackstone and the outlet of Worcester Long Pond, with that beyond, presented many serious obstacles to the construction of a canal, it was deemed expedient to direct a trial level and survey to be made, of this difficult portion of the line, and the following, very satisfactory report, was presented by the Engineer.

Worcester, August 24, 1825.

Dear Sir,—I send you some memoranda relative to my trial surveys from Spencer to Grafton. I do not know whether you will find them satisfactory or answerable to the expectations of the Commissioners. I have been constantly occupied on the surveys, and have not had sufficient time to make them so full, as perhaps was contemplated by my instructions. But I am anxious to get to Bolton to night, and if you wish for farther information, I shall certainly attend to your instructions, when I have the pleasure of hearing from you.

Very truly yours,

L. BALDWIN.

Gen. H. A. S. Dearborn.

Minutes of Survey and Level from Spencer to Grafton.

The heights are marked in feet and hundredths —the distances in miles and thousandths.

	FEET.	MILES.
Rise, from Mason's meadow in Spencer, in front of Wilson's tavern, near old factory, to top of ridge in Bemis' land,	175.92	1.308
The Fall from the top of ridge to meadow and swamp, on east side, is about 20 feet in 10 rods,		
Fall from *top of ridge* to high water mark in Burncoat Pond, along meadow, &c. not difficult,	60.98	1.390
Fall from Burncoat Pond, along meadows, swamps, &c. and crossing a small ridge in Sprague's land, to surface of meadow east of *Sadler's*, by junction of *Town Meadow Brook*, in Leicester, with Burncoat Brook, not difficult,	92.33	2.137
Town Meadow, in Leicester, is 85.86 feet above Sadler's Meadow; distance 1.670 miles,		
Do. *from Sadler's Meadow to Henshaw Pond*, at the outlet, southwest side of Pond,	19.80	1.723
On this section, high ground and Livermore's Ridge must be crossed, in Cheney's and Livermore's land, in Leicester. The highest point, by the road at Livermore's is 45.03 feet above *Sadler's* Meadow. But the cutting 41 rods, west of the ridge, would be but 27.83 feet, while the level of Sadler's Meadow		

comes through the ridge at about 50 rods east of the summit. If the line should ever be examined again, better ground is to be found, and although embankments will be required across Sadler's Meadow, I do not think this section is difficult for a canal,		
Fall from *Henshaw Pond* to top of flume sill at Bottomley's saw-mill, which is 12.40 feet below Full Pond, near the road,	83.80	1.702
This distance is round the pond, on the south side, where the survey was taken in the woods, without following the margin of the pond, to the north-east corner, where the level commences again at the surface of the pond. The chief obstruction on this route is Henshaw's Ridge, the highest point of which is 40.78 feet above surface of pond, and the level would come out at 36 rods on the eastern side. This ridge, therefore, can be considered no serious difficulty. This section passes Watson's Pond and mill. After crossing Henshaw Ridge, the waters fall into the Blackstone,		
Fall from Bottomley's to west side of the ridge, below Pierce's mill, near the road,	115.92	1.074
This line passes Sargent's, Adams' and Pierce's old mills, and is mostly along meadows		

and a deep ravine, with ledges, rocks, &c. The survey terminates in the deep rocky bottom of the river, below the road, about half a mile west of Jones' tavern,		
Fall, from *Western side of Ridge*, to the meadow by the junction of *Kettle Brook*, and *Half-Way Run*, which form the head of *Blackstone River*, at *New Worcester Village*, at the Oxford road, by Hale's factory,	125.47	1.158
Between the termini of this section, the Brook makes a great bend round to the south. But the Canal may be conducted over ground very favourable, and fall into the meadow, or low ground, near the Brook, on a different course. The only obstruction of consequence, is the ridge at the commencement of this section. The highest point south of the road, is 48.24 feet above the termination of the preceding section, and the same level, from this point, comes out on the east, at about 30 rods from the west side. As the Canal would of course be raised by embankments, on the west side, I consider this ridge of little moment,		
Fall, from meadow at *New Worcester*, to level of *Burbank's Pond*, at *Double Cherry-tree*, by		

bridge on the left bank of the Blackstone	31.19	2.042
This line passes along the upland on the left bank of the Blackstone river to *Smith's mills*, and factory, now rebuilding; but the canal may be conducted along the bank of the river, or kept upon the upland, according to the level with which it crosses the meadow at New Worcester. From Smith's mills, it follows the meadow and bottom land of the river, leaving Fox's factory on the left, to the junction of the Worcester Brook. Thence it follows the left bank, through swamp land, and crosses a ridge of rock and ledge to the bridge by Burbank's. The highest point of the ridge above the swamp is 11.45 feet; the cutting through would be 30 or 40 rods		
Fall, from *Burbank's mill pond* to Mrs. *Waters' land*, north side of the road by school house, half a mile north of Milbury factory, at foot of ridge	30.07	3.379
This part of the line, is along the valley of the Blackstone, and generally follows the course of the Blackstone Canal survey. No difficulty occurs by following the line with this fall; but to keep up the level from Burbank's, so as to cross the ridge, next to be noticed, would be troublesome,		

as the steep sloping, high *ground*, along the river valley is full of rocks and some ledges.		
Fall, from west side of ridge in Mrs. Waters' land, by the school house, to east side, to elm in March's land, near the factories in Millbury, is	8.17	0.234
The level from the *west side* should come out, on the east, at about 50 rods. The highest point is 43.77 feet, above the level on the west side, at 13.70 feet above Burbank's pond. The level may, however, be so laid as to cut this ridge, without difficulty, and drop into March's land, on the east side, if the level is kept up from Burbank's. But it would be better to drop, so as to cut through 25 or 30 feet below the top.		
Fall, from *East side of the ridge*, near Millbury, to the *meadow*, just below Dorerty Pond, at the outlet, about one foot above the surface of the pond.	12.37	1.081
After passing the aforesaid ridge, there may be a canal without difficulty to the valley of the outlet of Dorerty Pond, although the line surveyed, is not, perhaps, the best.		
Fall, from *Dorerty Pond* meadow to Pierce's meadow.	11.41	1,380
A cut through to Pierce's meadow, from the level of Dorerty Pond, would be about 24 feet, at the		

deepest, near Pierce's meadow, and the ground gradually rises from the pond, through meadows and swamps, to near the highest point, where it drops quick to Pierce's meadow. By keeping the level up, and banking a few feet over Dorerty Pond meadow, the canal might be easily effected; I think it best, however, to cut through, to feed from the pond.

Fall, from *Pierce's Meadow* to top of *Hovey's dam*, on the outlet from *Long Pond*, near Putnam's mills.	20.06	1.130
For this distance, a canal could easily be made. The top of Hovey's dam is 1.60 feet below present surface of Long Pond.		
Fall, from *Hovey's dam* to *Charlestown Meadow*, near *Wild-cat Swamp*, the water of which runs to the Concord River, by Kimball's	38.09	2.878
The line from Hovey's Dam passes round the point of the ridge, near Putnam's mills, and then over ground, too low for the canal, for some distance, into Moses Adams' land, where the level enters the hill and comes out again, near the edge of Charlestown meadow, the distance of cutting being about a mile and a half; but the ground rises and falls gradually, on each side		

	FEET.	MILES.
of the highest part of the ridge, which is 52.64 feet above Hovey's dam, and 51.32 above Long Pond.		
Whole fall from top of the Ridge in Spencer, to Charlestown meadow,	649.66	
Whole distance surveyed		21.308

I carried the level across the ridge, by Meriam's house, from the river, from Long Pond, near the *Indian Wiers*, to the other line, and found the highest point of Meriam's Ridge to be 33.51 feet above the pond. The ground rises pretty uniformly, and descends in the same manner, from the ridge; and the cutting level through, would be about half a mile. Should this pass be made, instead of going round by the mills, the canal may easily be brought from Pierce's meadow, noted above, and after passing the ridge, more favourable ground be found.

Except the deep cutting, this would be the preferable route, and I am inclined to think, that further trials would show, that, under all circumstances, this is the best direction.

Shaw Pond in Leicester is 33.96 feet *above* the summit ridge in Bemis' land, and Whittemore Pond is 83.41 feet *below* the same point. The town meadow, in Leicester, which has been shewn as a suitable place for a reservoir, is 85.86 feet above Sadler's meadow, and 67.55 below the summit.

If a pass should be effected through the Spencer ridge, for a summit level, I think it should be sunk to a level with Burncoat Pond. This would make a tunnel necessary, of about a third, or half of a mile long, by driving up the headings, on each side, to about thirty feet cutting. But it is impossible, without trying Turkey Hill Pond, and gauging all the proposed feeders, to determine, what level to

adopt for the summit. Shaw, Whittemore, and Burncoat Ponds, were in an unusually low state. All were drawing off for mills, and much below their common level. Burncoat Pond was almost drained, and no water was running from Henshaw Pond. To attempt gauging them, in the state in which I found them, would be useless,—or at least, unsatisfactory. I therefore concluded it best to suspend the survey, from Turkey Hill Pond and other feeders from Paxton, until I made the general survey, when I would take measures to gauge them all.

The ridge at the summit level, and that by Kimball's, east of Long Pond outlet or river, if the canal is to be fed from Long Pond, are the principal difficulties in this part of the route. As it is desirable to take Long Pond water, I do not see how the last ridge is to be avoided. A tunnel or very deep cutting, is unavoidable. As to water, no good opportunity has occurred to estimate the quantity, and this is necessarily delayed for further examination.

L. BALDWIN.

Worcester, August 24, 1825.

From this trial level it appears, that the ridge in Spencer is $529\frac{49}{100}$ feet above Burbank's mill pond, in Worcester; and Mr. Hutchinson, the engineer, who made the survey of the route for the Blackstone canal, ascertained the height of that pond to be $434\frac{44}{100}$ feet above the ocean, which makes the whole fall from the summit level to Boston Harbour $963\frac{93}{100}$ feet, and to the mouth of the Chickapee 932.43 feet, as the descent from thence to the tide water, on the Connecticut is $31\frac{1}{2}$ feet.

To supply the lockage, from the summit level, west, to Seven-mile River, and east to the Blackstone, the chief reliance is upon Bumscut Pond in Paxton, Turkey Hill Pond, through which the boundary line between Rutland and Paxton passes, Whittemore Pond in Spencer, and Burncoat and Henshaw Ponds in Leicester; but all these ponds are not sufficiently elevated to feed the line, along the summit level, but may be brought in at points below.

Bumscut, or Asnabumscut pond, in which one branch of the Nashua has its source, contains an estimated area of one hundred acres, and probably more.

Turkey Hill Pond is one of the fountains of Seven-mile River; is a mile and a quarter northwest from Bumscut Pond, and forty or fifty feet lower, having an area of 200 acres. It is on the summit, between the waters, which fall into the Nashua and Chickapee Rivers; and it was stated there was formerly an artificial channel, of only five or six feet deep, through which the water flowed east, through a swamp, into the former river, which could be opened again, at a trifling expense.

There is a very large meadow, below Turkey Hill Pond, that abounds in springs, and is annually overflowed, by the melted snow and vernal rains, which may be converted into an immense reservoir; and its water, with that from Bumscut and Turkey Hill Ponds, could be conducted into a general reservoir, formed by throwing a dam across Seven-mile River, near Jennison's mills, a mile and a quarter below Turkey Hill Pond, and from thence conveyed in a feeder, which can be cut through a valley, to the summit level in Spencer.

Shaw Pond is two miles north of the summit, and has an area of 100 acres and, as its outlet, falling

into Seven-mile River, will be intersected by the feeder, from the reservoir in Paxton, it can thus be made tributary to the canal.

Whittemore Pond is situated in the rear of Spencer meeting-house; has an area of 70 acres, and may be used to supply, in part, the western lockage.

The canal line runs along the margin and across the outlet of Burncoat Pond, which has an area of 200 acres, that could be trebled, by the erection of a dam, fifteen or twenty feet high, at the outlet, as there is an extensive tract of swamp and meadow land, which would be thus flowed, nearly to the eastern end of the deep cut, or tunnel, through the summit ridge; distant one mile.

Henshaw Pond, passing the northern end of which, the line of canal crosses the ridge to the east, has an area of 80 acres, which may be very much extended, by a dam at the outlet.

After passing the ridge, east of Henshaw Pond, Kettle Brook, Halfway River, and other streams, fall into the canal route, and ultimately constitute Blackstone River, which, with the waters of Long, Dorerty, Flint, and Half-Moon Ponds, must be relied upon to supply the canal to Concord River.

From the ridge, on the eastern side of the outlet of Long Pond, near Meriam's house, the route, for three miles, passes through Charlestown Meadow, and a vale, to Parker's mill, in Westborough, situated a mile south of Worcester Turnpike.

A reservoir, containing an area of four or five hundred acres, can be formed, by erecting a dam near Parker's mill, twelve feet high, across the stream, which has its source, in meadows and swamps, in the northern part of Grafton.

The line continues from Parker's mill, northeasterly, near Warren's house, distant one mile from

the turnpike ; thence, north of the meeting-house, and village of Westborough, over quite level land, between Cook and Cedar Ponds, and along the northeastern side of the latter, to Belknap's mill, on a branch of Framingham, or Concord River. A mile above the mill, the outlet of Cedar Pond enters the river, passing, with a sluggish current, through a swamp, which circumvallates the pond, and a meadow east of it.

This branch of Framingham River, has its source in Whitehall Pond, situated in Hopkinton. The pond has a natural area of 400 acres, but a dam has been erected, which extends the surface to more than a thousand acres.

Cedar Pond may be rendered a valuable reservoir, in the same way.

Except for about three fourths of a mile, between Belknap's mill and the northern end of Cedar Pond, where ledges and large rocks constitute the slope of the hill, but not very difficult to pass, the route, from the eastern side of Meriam's Ridge, is remarkably feasible, the descent being gradual, the fall not great, and the soil, generally, sandy loam and gravel, with, occasionally, boulders and beds of clay.

Passing down the left bank of the river, through Southborough and Framingham, this route unites with the explored Bolton line of Canal, near Framingham falls.

There are two other routes from Springfield to Boston ; one, which leaves the Chickapee at the mouth of Ware River, and ascending up its valley, passes over the highlands in Rutland and Paxton, to the Nashua, and down the basin of that river, to the Bolton line, which it then assumes : the other

turns to the northeast, from the Springfield and Worcester route, near the bridge, in the western part of Spencer, and continuing up the valley of Seven-Mile River, intersects the Ware River route near Turkey Hill Pond, in Paxton and Rutland.

WARE RIVER ROUTE.

At Learned's mills, two miles from the mouth of Ware River, is a fall of fifteen feet; from thence to the lower dam of Ware factory, eight miles, there is an ascent of sixteen feet, but chiefly within a half a mile of the dam; the river having quite a gentle current the remainder of the distance, and its banks favourable for the construction of a Canal.

From the foot of the lower factory dam, to the top of the upper one, a distance of eighty rods, the fall is 64 feet.

Half a mile below the lower dam, Muddy Brook enters the river, having its source in the ponds of Hardwick. It affords sufficient water for a paper mill, and one is speedily to be erected.

Four years since, there were only five buildings in Ware Factory Village, and when the Commissioners passed through it, there were the following:

A cotton factory containing 2,000 spindles, and 56 looms; another nearly finished, to contain 4,500 spindles, and 150 looms; a third of the size of the latter, commenced; a flannel factory, in which are made fifteen pieces per week; fifteen edifices used as store, dye, wool and ware houses, machine, blacksmith's, cabinet-maker's, and various other shops; grist and saw mills, a furnace, thirty dwelling houses; and other buildings now erecting, making the whole number of structures fifty-eight.

The land on both sides of the river is hilly and filled with ledges, from the upper mill-pond, for nearly one hundred rods below; but there will be no serious difficulty in locking by these falls; from whence, to Anderson's mills, in Hardwich, four miles, there is a margin of interval, or low land, of easy excavation, and the ascent so gradual, that there is scarcely a rapid in the river.

From the foot of Anderson's dam, to the top of Smith's, within a space of 50 or 60 rods, there is a fall of twenty-four feet. At these falls are furnaces for castings of all kinds, but chiefly hollow ware; made principally from iron ore, obtained in the bogs and meadows of New Braintree and Brookfield.

The river, for five miles, to White's Mills, where there is a fall of five feet, is navigable for boats; and either bank offers, favourable land for the bed of a canal.

A mile and a half below White's Mills, Moose Brook, which has its source in the north-west part of Barre, falls into the river; it affords considerable water; near its mouth is Billings' furnace; above are grist and fulling mills.

The route to Pratt's mill, three miles from White's dam, continues to be favourable, the river being bordered by glades of level land, and the descent gradual.

A few rods below Pratt's dam, Wadsworth's brook enters the river; it affords water for several saw and grist mills. The whole fall, from Pratt's dam to the Chickapee, is estimated at only one hundred and fifty feet.

At Oakham village, fourteen miles above Ware Factory, the canal line leaves the valley of the river, and extends east, crossing the outlet of Demond and Long Ponds, in Rutland; thence past

the north side of Turkey Hill pond, four miles from Ware River, to the outlet of Bumsket Pond, and down its valley,—three miles, to Kendall's mills, in Holden; situated a mile and a half above the mouth of the Quinepaxet; thence crossing the Quinepaxet, to the route from Westminster, which is intersected near Washakum Ponds in Sterling, eight miles from Kendall's mills; or the line may be continued down the valley of the Quinepaxet to the Nashua, and thence down the valley of that river, to the point, where the Westminster and Sterling line of canal crosses it,—a mile and a half below Sawyer's mill, and $13\frac{1}{2}$ from Kendall's, in Holden.

Demond Pond is one mile and a half south of Rutland meeting house, and has an area of 75 acres.

Long Pond is half a mile west of, and 50 feet lower than Demond Pond; it is one mile and a half long, and from a quarter to a third of a mile wide.

Turkey Hill Pond is a mile and a half south-easterly from, and fifty feet higher, than Demond Pond; but there is a ridge between them, which will require a cut 20 or thirty feet deep, for a quarter of a mile.

On the eastern side of Turkey Hill Pond, is a swamp and meadow, through which, as has been stated, was formerly an artificial channel, to the outlet of Bumsket Pond; and it was apparent that but little extra cutting would be requisite, to turn the water of the pond in that direction.

In adddition to the ponds named, for supplying the lockage over the summit level, are Musquepogue, in the north-eastern part of Rutland, and Quinepaxet, in the south-eastern corner of Princeton;—the former has an area of eighty acres, and may be considerably extended, by a dam at the outlet.

The hydraulick powers, on this line of canal, from Ware River, are numerous, and have been extensively used. In Oakham village, are grist and saw mills, a trip-hammer, clothier's works, and a cotton factory;—in Rutland, are saw and grist mills, clothier's works, and a trip hammer;—in Holden, are six saw, and three grist mills, machine, cotton and woollen factories;—and in West Boylston, are several mills, and two cotton factories.

SEVEN-MILE RIVER ROUTE.

Ascending Seven-mile River, there is a rapid, a few rods above Spencer Bridge, in the course of which there is a fall of ten feet. Four miles above is How's mill, from which there is a fall of 60 or 70 feet to the rapids; from thence to Jennison's mills, three miles, with an ascent of 70 feet; and thence, to Turkey Hill Pond, the ascent is fifteen feet, making the whole fall, to the Apron of Gallup's mill, only 174 feet. The height of all these falls, and rapids, was merely estimated, but by various persons, who were presumed to be best able to give approximated results, from their familiar knowledge of the topography of the country; still they must have been wide from the actual elevation of Turkey Hill Pond, which is conceded to be higher than the Spencer summit level; and that, it has been ascertained, is 932.43 feet above the Connecticut, at the mouth of Chickapee River; and, deducting the fall from Spencer bridge to the same point, which, as nearly as it could be ascertained from a reconnoisance, and the information procured from persons residing on the route, amounts to only 380 feet, would make the whole fall from Turkey Hill Pond $552\frac{43}{100}$;—

but the descent from Spencer Bridge is, probably, more than one hundred feet greater than has been assumed, which would make the Paxton and Rutland summit level, four hundred and fifty-two feet above the surface of Seven-mile River, at Spencer Bridge.

The banks of the river present no formidable obstacles to the location of a canal, the acclivities being gradual, and generally free from ledges, or large rocks; the distance between seven and eight miles.

This was a portion of one of the routes, surveyed, from Connecticut River to Boston, by John Hills, for General Henry Knox, in the year 1791; but, instead of passing into the valley of the Nashua, from the summit level in Paxton, his line entered the basin of Half-way River, and continued down it to the Blackstone, making a circuit of twenty-one miles; the direct course being only about seven.

WESTMINSTER AND STERLING ROUTE.

At a meeting of the Commissioners, in Boston, on the first day of September, the Engineer's reports of his surveys, of the difficult portions of the Worcester and Bolton routes, having been examined; and intelligence having been received, that Bolton Ridge might possibly be avoided, by pursuing a more southern course from Westminster, and crossing Nashua River higher up, than had been attempted, it was concluded, that the following instructions should be transmitted to Col. Baldwin.

Boston, September 3d, 1825.

Dear Col.—Your letter, containing the result of the remainder of the survey, over Bolton Hill, has

been received, and was, with your former communications, laid before the other Commissioners, on the 1st inst. who were perfectly satisfied with them, as they embraced all the information, that was desirable, at this time.

I am requested to inform you, that, at a meeting of the Board, this day, it was concluded not to be necessary to make any change in the instructions, which were given to you, previous to your departure, for commencing the surveys on the northern and southern routes,—except, that, when you have completed the survey, west of the summit levels in Westminster, and Ashburnham, and one of those from the same summits east, you will explore the following route, which Mr. Lees, of West Boylston, has represented to us, as preferable to that over Bolton Hill, viz.:

From Westminster, through Sterling, West Boylston, and Berlin, to the eastern part of Bolton, near Hildreth's Tavern. He thinks the high land east of the Nashua, by keeping up the level, on the abovenamed route, can be passed, *without* a *tunnel*, or even a *very deep cut.*

We shall leave this, on the 10th of October, to make reconnoisances of the routes, from Fitchburg, through Lunenburgh, &c. to Charles River; and from the eastern, or Nashua Pond, in Ashburnham, through Ashby, &c.; and hope to have the pleasure of meeting you before our return; and, therefore, request that you would inform us, as early as the 5th of October, where you probably will be on the 10th.

Col. Hoyt leaves this City on Monday next, and will pass a few days with you, before he returns home, and will supply you with funds.

Very respectfully, your most ob't serv't,

H. A. S. DEARBORN.

Col. L. BALDWIN.

Bolton, October 7, 1825.

Dear Sir,—This morning, I had the pleasure of receiving your obliging letter of the 5th inst.

I finished exploring the new route from Westminster, last evening, and stop here to comunicate the result.

I have made out the enclosed sketch of the line I examined, by which you will be able to understand the position and character of the principal points. Many particulars and minutes are stated on the sketch; such as the distances from Westminster, the roads, &c. and I hope, by the aid of this, and the few remarks, which follow, you will be able to judge of the expediency of the survey.

From Westminster to the outlet of Wachusett Pond, two and a half miles, there is considerable fall, and the ground very irregular and uneven. It passes the outlet of Westminster Pond, which may be easily taken into the Canal. From Wachusett outlet, the land presents a favourable surface, by Williams', Everett's, and Graves' Ridge. This ridge is, perhaps, 20 or 25 feet above the pond; consists of rocks and ledges, and would require cutting 60 or 70 rods, where the level would come out above Emerson's saw-mill, in Everett's pasture, distant about four miles. The ridge is steep, on the west, by the swamp, and slopes gradually on the east side. But whether the canal should be cut deep enough, at the outlet, to feed from the pond there, or only sunk deep for this purpose, near Everett's, and carried through the ridge, can only be determined by levels.

After passing the ridge, which is rocky, with perhaps some ledge, the ground falls fast, for some distance, and also at intervals, to near Buss', 8 miles. The surface is very rocky, and there is a rapid fall at Keyes' mill, two miles above

Buss'. For about two miles, to Burpee's, the ground slopes, gradually, to the river on the right, and any level may be taken; but at Burpee's, high level plains begin, composed of sand and gravel, probably, and the same general character extends to Lufkin's, which is ten miles from Westminster.

These plains are sometimes detached, with ravines between them, and project to the swamps, and low grounds of the brook. If these are not too high, a level may be taken, from the brook above Buss', and carried round, in a pretty regular course, to where it will be necessary to cut through by Brigham's, to a level with Washakum West Pond, in Sterling, 11 miles. Some deep cutting, on a crooked line, will be unavoidable, near Brigham's, to get to the pond. The line which, probably, may be pursued here, as well as in many other parts of the route, is marked on the sketch, by a strong black line.

If the level can be continued to the west pond, I should think the canal might be kept along the north-east side of the west pond, across the meadow and swamp, which lies between the ponds, obliquely;—then follow the south shore of the east pond, and so east to Colonel Hastings' Drain, which the Commissioners will probably recollect, is near his house.

After passing from this pond, there seems very little difficulty in getting to the Nashua, 15¼ miles. Some low ground, and hollows, must be passed; but the soil is of a nature easily excavated, and nothing seems forbidding in this section. But a high level, say 40 or 50 feet at least, and higher if the shores will admit of it, must be carried across the river, to lessen the deep cutting, through the high swamp, between the river and Snake Hill, in Berlin. What the height of this swamp is, above

the river, it is difficult to tell; but, I think, it cannot be less than 70 to 100 feet. The cutting may be a quarter of a mile long. It will be possible to carry the canal near the road, across the Snake-hill, as indicated by the line, which will save a circuit of a mile, or more; and, after passing the swamp, and Snake-hill, no difficulty is presented in conducting a canal to the meadows of North Brook, below Pollard's mills, by Moore's store. These mills are supposed to be $17\frac{1}{2}$ miles from Westminster, on the line explored.

From all the accounts I have received, and from my own recollection of the country, there can be no doubt a canal may easily be carried down the valley of this brook, which takes the name of Elizabeth River, in Marlborough, to the line contemplated across Sudbury meadows.

But to connect this line, with that through Bolton, at, or near, Hildreth's tavern, or any other point, seems to present insurmountable obstacles. From Pollard's mills, the ground is very irregular to Howe's tavern, near Berlin meeting-house; so that whatever level is taken from the mills, the route would be circuitous, and, after passing the meeting-house, the line turns round, on the left, towards Hog Swamp. To gain this swamp, the land rises very much, and some deep cutting will be required, to get to the level of the swamp; and even this, I think, must be higher, several feet, than any level which can be brought from the mills. Could a level be made to meet the surface of the swamp, which extends, probably, two miles, all difficulty would be removed; and passing Pollard's mills, on the Wattaquattick, the outlet, from the swamp, the canal may be carried, by the West and Little Ponds, in Bolton, to the old Bolton line, near Sawyer's grist mill, by the turnpike.

The estimated distance, on the line I have examined, is 23 1-4 miles, from Westminster to Sawyer's mill.

Upon the whole, although the new route offers many irregularities, and much rough ground, it is not so bad as to forbid a trial, and I cannot but express an opinion, that it ought to be surveyed and levelled. If it should turn out, that a continuation from Pollard's mills, in Berlin, to the old Bolton line, is impracticacle, as, I believe it will, there can be no question, as to its continuation through Marlborough, and, perhaps, on as short a line, as that from Berlin meeting-house, by Sawyer's mill and Hildreth's tavern.

In the full belief that this new line should be tried, especially, when such an obstruction as Bolton ridge is to be avoided; I propose the following course in my surveys. First, to extend the Ashburnham survey, by Fitchburg to Leominster; second, resume the survey from Bolton at Wattaquattick Brook, and connect it with the Westminster level. This will fill the gap between Westminster and what has been done in Bolton and Leominster, about ten or twelve miles, and give useful data for determining the relative positions of any points, on that, and the new survey through Princeton and Sterling. Third, to take up the survey from Westminster, through Princeton, Sterling, Boylston, Berlin, &c. ;—and if it shall be found impracticable to cross over from Berlin to Bolton, to proceed down the North Brook to Marlborough, Stow, &c.

By this route, Westminster, Wachusett, and Washakum Ponds may easily be taken, without the expense of feeders, and all of them are suscep-

tible of being turned into highly important reservoirs.

With great respect and esteem,
Your obedient servant,
L. BALDWIN.

Gen. H. A. S. DEARBORN,
Canal Commissioner.

It was intended to have had a trial level, run over this line, from Westminster to Berlin, and extended the reconnoisance to Charles River; but there was not sufficient time to effect either.

ASHBURNHAM ROUTE

When the Commissioners passed through Fitchburg and Ashburnham in July, it was considered necessary, from the representations there made, by committees from several towns, that two other routes from the Naukeag Ponds, to Boston, north of the Bolton line, should be examined, which they determined to do, early in the autumn, and on the tenth of October, reconnoisances were commenced.

A route was first explored, from Waltham, through Weston, Lincoln, Concord, Acton, Boxborough, Littleton, Groton, Shirley, Lunenburg, and Fitchburg, to the summit level in Ashburnham; which having been subsequently surveyed, as the continuation of the line of canal, up the valley of Miller's River, it is unnecessary to give the results of the researches which were made, as all the requisite information is contained, in the

very able report of Col. Baldwin, the Engineer, of an entire northern route, from Boston Harbour to Connecticut River.

After the explorations of the Bolton and Worcester routes, the others connected with them, and those between the Connecticut and Hudson Rivers, were finished, it was anticipated, that it might not be possible to have surveys completed of an entire southern and a northern route ; and, in the event, there should not be sufficient time and funds to accomplish those labours, it was deemed expedient, first to have trial levels run over the most difficult portions of the Worcester and Bolton lines,—the results of which, have already been exhibited, and the following instructions were given to the Engineer.

Boston, August 8, 1825.

Sir,—We having completed the reconnoisances of the northern and southern routes for canals, from Boston Harbour to the Connecticut River; you will please to commence the following surveys.

First.—Run a level from Seven-Mile River, in Spencer, over the summit level in that town and the heights of Leicester to the Blackstone River, in Worcester, and down the valley of that river to the most practicable point for crossing, into the basin of the outlet of Long Pond; thence over the ridge, near Meriam's house, to a point in the meadow, north of Kimball's farm, and east of said ridge, which shall be as low as the surface of Long Pond.

You will ascertain the practicability of supplying the summit level of Spencer, and the canal east of the outlet of Long Pond, with water; and the sources from which it can be derived.

Second.—Run a trial level over Bolton Hill, and the valley of the Nashua, to some point in Lancaster, or Leominster, to ascertain whether it can be kept up sufficiently high, to cross the Nashua River, in the southern part of Lancaster, and pass over Bolton Hill; and if not, how deep a cut must be made to effect it; or whether it will be best to tunnel the hill.

When the two trial surveys have been made, you will please to report the results to the Commissioners, with your opinion of the best mode of surmounting such difficulties as may occur, on either of the two routes, proposed for canals.

Third.—Unless otherwise instructed, you will then proceed to survey the whole of the northern canal line, from the mouth of Miller's River, to Boston, as well, through Westminster, as Ashburnham, and make such lateral surveys, as may be necessary to ascertain the best route; or for obtaining reservoirs, or feeders, for supplying the canal with water; and you will also gauge the ponds and streams, which are to be made use of, for that purpose.

Fourth.—Survey the southern route of a canal, from Boston Harbour to the mouth of the Chickapee River, in the same manner, as has been directed, in relation to the northern route.

You are authorised to employ George R. Baldwin, as an Assistant Engineer, at three dollars per day, and pay his expenses, while under your direction; two chain-men, one axe-man, a man to carry your instruments, and such others, as you may find absolutely necessary, to facilitate your labours, and at as low wages, as proper men can be obtained for.

When your surveys have been completed, you will please to prepare, and present, plans and re-

ports of both routes, with the estimated expense of each.

Very respectfully,

Your most obedient servants,

N. WILLIS,
E. HOYT,
H. A. S. DEARBORN.

Col. L. BALDWIN.

As it was possible, that but one entire route could be surveyed, the preference was given to the only practicable northern line, west of the crown summit level, and the Commissioners were induced to come to this decision from the following considerations.

Having ascertained, by reconnoisances, that the best route from Connecticut River to the Hudson, was up the valley of Deerfield River, and down that of the Hoosack ; and in the event that the latter canal should be made to complete the navigable line of communication between the Erie and Champlain Canals, and Boston Harbour, the natural course of its extention was through the valley of Miller's River, to the Ashburnham or Westminster summit levels, and from thence, in the direction of one of the proposed routes to Boston. But if the views of the Legislature should be limited to the line to Connecticut River,—Worcester Long Pond, the Blackstone, and all its tributary streams, Dorerty, and several other ponds, having been, unfortunately, ceded to the Blackstone Canal Company, it was doubtful whether sufficient water could be commanded, to meet the consumption of a canal, from the western bounds of Worcester, to Boston Harbour, if the southern route should, in other respects, be found to be more feasible and expedient than any other.

On the completion of the reconnoisance of the Ashburnham, or Lunenburg route, it having been ascertained, at a meeting of the Commissioners and Engineer, in Ashburnham, on the twelfth of October,—upon an examination into the accounts of the expenses which had been incurred, that the balance of the funds appropriated, would not enable them to complete the survey of more than one route, it was concluded to pursue that through Fitchburg, Lunenburg, &c. as it presented less apparent difficulties than the one through Bolton; for even if the still more northern route, through Ashby, should be found, on examination, to pass over still more favourable land, it having been ascertained that its summit level would be $63\frac{57}{100}$ feet higher, than that from Miller's River to Lunenburg, it would not be so eligible; and the result of our explorations will shew, that from the eastern part of Westford to Lexington Common, the obstacles to be encountered are more formidable than on the Bolton line.

ASHBY ROUTE.

This route, from Miller's River, passes along the northern shore of Great Naukeag Pond, in Ashburnham, and round the north end of the eastern or Nashua Pond, into a meadow, which extends in a north east direction, from a ridge, which forms the eastern bank of Nashua Pond.

A feeder, of 30 or 40 rods in length, and from 10 to 30 feet deep, must be cut through this ridge, near Lawrence's house, to convey the water of the pond into the canal.

After entering the meadow, the line of canal extends along its northwestern margin, to the outlet

of Stodder meadow, which contains 150 acres; and by erecting a dam, not more than 100 feet long, it may be flowed ten or twelve feet; and from the quantity of water, which constantly flows, from the meadow, there is no doubt, that an extensive reservoir can be formed. This experiment was resorted to, by the proprietorsof the meadow, to destroy the small trees, shrubs, and flags, with which it was covered, and it was flooded for several years, three or four feet deep.

From the outlet of Stodder meadow, which flows into Scowhegan River, in the State of New Hampshire, the route passes east of two ponds, which are situated near the eastern base of the Great Wattatick Mountain. The most southern of these ponds is a mile from the Eastern Naukeag, and has an area of 300 acres; the other, distant a quarter of a mile, includes a surface of 200 acres. They will afford a great supply of water, and can be tapped without difficulty, and at a small expense, the distance from the canal line being but one or two hundred rods, and the land a swamp.

From the meadow, east of the ponds, the route continues, for half or three quarters of a mile, to a valley, south of Keene turnpike, and down its right bank, to the village of Ashby.

Commencing a mile west of Ashby meeting-house, a more northern route can be pursued, which passes about one hundred rods north of the meeting house, and intersects the other line, at the foot of Battery Hill, in Townsend. The descent is less precipitous, and the ground more favourable for constructing a canal, on this line, than the one which passes south of the meeting-house.

The south canal line, continues from the western part of Ashby village, through a vale, to Willard's Brook, west of Howe's tavern, on the plain, near

the foot of Battery Hill, in the western part of Townsend.

It was stated by gentlemen in Ashby, that there was a practicable route, from a point, one hundred rods southeasterly from the meeting-house, which passes through the northern part of Lunenburg, and down the valley of the Mulpus, or Mulapus River, through Shirley, to the Nashua.

The fall, from Ashby meeting-house, to the foot of Battery Hill, distance between three and four miles, was estimated to be over 500 feet.

The banks of the valley are chiefly composed of gravel, rocks, and ledges; but the bed and locks of a canal, can be laid, without great difficulty, and the course is pretty straight.

A quarter of a mile east of Howe's tavern, Willard's, Pearl Hill, and Locke's Brooks, and one from Mason, in New Hampshire, unite, and form Squanicook River.

Pearl Hill Brook, has its source in two small ponds, in the southern part of Ashby. It is a perennial stream, and affords sufficient water for one grist, and two saw mills, and a trip hammer.

The canal line from near the confluence of the streams which constitute the Squanicook, is on the right bank of that river, to the village of "Townsend Harbour," which is distant eight miles from Ashby, and two from Townsend meeting-house. In this village are grist and saw mills, and clothier's works.

Two miles below Townsend Harbour, is Nutting's Bridge, over the Squanicook, and one mile and a half from its mouth. The route, continuing on the right bank, can be extended to Staples' mills, on the Nashua, from a point, sixty or eighty rods above Nutting's Bridge, through a valley and low land, in nearly a southern direction.

Eighty rods above Tarbell's mills, which are half a mile from the mouth of the Squanicook, the line of canal leaves the bank of the river, and passes southeasterly, crossing the Nashua, thirty or forty rods below Page's Bridge, and nearly the same distance above the Squanicook. On both banks of the Nashua, the interval land is so elevated, as to require embankments of not more than twenty rods in length, and eight feet high : and it will not be necessary to raise the aqueduct, over the river, more than fifteen feet, above its usual summer surface.

The distance from Townsend Harbour, to this point, is five miles, and ten from the base of Battery Hill, with a fall of only 80 feet, to Tarbell's mills, and 40 from thence to the Nashua ; the whole canal line passing over an extensive plain, the soil of which is loam, sand, gravel, and stones, without the presentation of a single ridge to cut through, or valley to embank over, of any consequence.

Mulpus River rises in the highlands in Fitchburg, Ashby, and Lunenburg, and passing through the latter town, and Shirley, enters the Nashua, from a third to half a mile, above the Squanicook. It is a considerable stream, and there are several mills upon it, near its mouth.

The route, from the Nashua, continues over plains, on quite level land, without any very great impediments, through the southern part of Groton, to the Cuttecoonemugkeag, the outlet of Sandy Pond ; thence along the southern side of that pond to Spectacle Pond, situated between Groton and Littleton. These ponds can be used as reservoirs. Spectacle Pond is a mile and a half long, but narrow, and may contain an area of 250 acres ; its outlet falls into Forge Pond, which is twelve feet lower, and distant, in a northeast direction, nearly half

a mile. A dam, 150 or 200 feet long, might be erected between the two ponds, where the banks are high, and the outlet narrow, which would flow Spectacle Pond, ten or fifteen feet; and it could then be tapped by a feeder, on its southwest side, near which the canal line passes, and continues through a vale round the northeastern end of Oak Hill, a spur of the Bolton range; and thence east, over low land, which extends south of Westford meeting-house, to Vine Brook, distant eleven miles from the Nashua.

To pass the valley of Vine Brook, will require an embankment twenty rods in length, and from thence to A. Parker's house, the route is over very rough ground, broken into deep vallies, hills of sand, and rocks, and elevated ledges, which will render many deep cuts, and high embankments necessary. From Parker's House, the line deflects northerly, and passes, for four miles, along the margin of a swamp, and Virginia meadow, to the borders of Carlisle; thence, through a ridge of rocks and ledges,—thirty rods, north of the meeting-house, in Carlisle,—which will require a cut, twenty feet deep, for forty rods, into a meadow, over which must be an embankment, eighty rods long, and twenty feet high, from thence to Concord river; the ground is favourable, with the exception of a little extra cutting.

The canal may be conducted, over Concord River, either above, or below the bridge, between Carlisle and Bedford; but it will require embankments, and an aqueduct, twenty feet high, and one hundred rods in length. From the more elevated land, above the wide margin of the meadow, on the eastern side of the river, the route bends nearly south, for a mile, through a swamp, to a ridge, or swell of land; through which, in a north-easterly di-

rection, must be extra cutting, ten or fifteen feet deep, for more than half a mile, into a meadow, which will require an embankment, six or eight feet high; and from thence, a short cut, ten or twelve feet deep, into low land, near R. Lane's house, crossing which, the line extends over the Shawsheen meadow, through which the stream of that name passes, and falls into the Merrimack. There must be an embankment, 80 rods long, and twenty feet high, with a large culvert, over this meadow and stream; thence, a cut through Farley Hill, for 90 rods, twenty feet deep, to the main part of Shawsheen meadow, to pass which, will require an embankment, 150 rods long, and twenty feet high, to the base of the Great Ridge, in Lexington, which presents a most formidable barrier to the prosecution of this line of canal; as the distance, from the point where the level strikes it, on the western side, to the place where it will come out, on the meadow, near Stephen Robbins' tavern, in Lexington, is three miles; one mile and a half of which, must be pierced by a tunnel, as the hill, in that distance, is from 35 to 100 feet high, and the headings, for the remainder of this difficult line, must be driven up, through coarse gravel, rocks, and ledges, of which the whole ridge is composed, from 20 to 35 feet deep.

From the eastern side, of the Lexington ridge, the ground gradually descends, about sixty feet, to West Cambridge common, distant ten miles, from Concord river, and twenty-nine, from the Nashua; from thence, the route may be extended, so as to enter the Middlesex Canal, in Medford; or, passing through Cambridge debouche, at Lechmere's point; or into Charles River, above West Boston bridge; or, it may take a more southern direction, from Lexington, and enter Charles River, below Watertown bridge.

The several routes which have been examined and described, are delineated on a map of the state, which accompanies the report.

ANALYSIS

OF THE

ROUTES TO CONNECTICUT RIVER.

From an analysis of the preceding reconnoisances and surveys, it appears, that in making a selection of the most practicable and expedient route, those of Bolton and Acton, are to be excluded; and if it shall be found, after actual surveys have been made, and the ponds and streams gauged, on the Worcester route, that the waters which have been ceded to the Blackstone Canal Company, are *indispensable* and *irreclaimable*, that line must be abandoned, as impracticable; but if water can be obtained, to meet the consumption of a canal, without infringing the rights of the Blackstone Canal Company, it remains to be considered, whether it has the preference, on the score of expediency.

If viewed in connexion with the projected canal to Hudson River, the facts heretofore stated, when assigning the reasons for commencing the survey on Miller's River, are conclusive against the adoption of so southern a line; but if it were possible to imagine that the range of internal intercourse by the means of canals, was to be bounded by the Connecticut, it remains to be inquired, whether, as respects the cost of construction, and public accommodation it is decidedly the most eligible route.

The first position cannot be ascertained until surveys have been made of the whole line of canal;

but it is probable, that it will not be less than the Engineer's estimate of the expense of constructing a canal on the Ashburnham route; the distance being nearly the same, and the physical obstructions quite as great, save the difference of the height of the summit level, which is more than counterbalanced by the feeder from Paxton.

If the obstructions, to boat navigation, were as great below Springfield, to tide water, as they are below the mouth of Miller's River, to that town, there can be no doubt, that the former should be the point of debouche, for a canal, as a greater extent of country, on Connecticut River, would avail of its facilities for transportation; but it is to be presumed, that when boats have passed down the river, over the various difficulties, which exist, from the mouth of Miller's River, they will continue on to Hartford,—the channel being clear, and the distance short, rather than proceed to Boston; and consequently, all the country, above Miller's River, instead, as is ardently desired, of looking to the latter city, as a great market, for sale and purchase, may gradually seek and ultimately find one in another direction, which would render a canal, that shall intersect Connecticut River, at Springfield, of little comparative consequence to Boston; besides, it has been shewn, that the "*Ware River Route*," is nearly as direct as that through Worcester, if connected with a more northern line; in the benefits of which, also, not only the town, but a larger portion of the county of Worcester may participate.

It thus appears, that the selection of a canal route, to Connecticut River, is to be made from the Ashburnham, and Sterling lines; and, if the latter is practicable, at an equal, or even a greater expense, than the former, it is preferable; for the numerous hydraulick privileges, on the branches of

the Nashua, in the vicinity of the route, will be speedily, and extensively, used for manufacturing purposes, and eventually furnishgreat traffic, for a canal; while the flourishing villages of Ware, and Chickapee Rivers, both offering most excellent sites, for all kinds of manufactories, will, ultimately, require the construction of the branch of canal, which has been explored up those rivers, to unite with the Ashburnham line ; a side cut can also be constructed to Worcester, through the valley of Holden Brook, and past North Pond, at not a very great expense, the distance being only eight miles; and the land has been represented as favourable, for the location of a canal.

But, should the Sterling route be adopted, it will become a qnestion, whether it will not be best to assume the Ashburnham summit level, instead of passing up the basin of Otter River, and over the summit of Westminster, as it is lower; and the canal, from thence, through the eastern part of Westminster, will be a substitute for the proposed feeder, from Great Naukeag Pond. This, however, must depend upon data, which can only be obtained, from the details of accurate hydrographical, and topographical surveys, and levels.

Without predilection, or prejudice for, or against, any route, the Commissioners have been anxious, dispassionately, to present the features, of all the lines of canals, so far as the facts, which they have been able to obtain, would warrant; but, it is possible, if other researches, and surveys, were made, that some more eligible route, might be discovered; —or those, which have been explored, so varied, or found to possess advantages, which were not apparent, from a mere inspection, as to make a different selection advisable, in preference to either of those, which, with profound deference, they have presumed to designate.

REPORT

OF

LOAMMI BALDWIN, Esq.

ENGINEER.

REPORT.

To Hon. Nathan Willis, Hon. Elihu Hoyt, and Gen. H. A. S. Dearborn, Commissioners, &c.

Gentlemen,

1. Having been appointed by the Governor of the Commonwealth, Engineer, to make the necessary surveys, plans, and estimates, for ascertaining the practicability of making a canal from Boston Harbour to Connecticut River, under the direction, and with the assistance of the Commissioners, appointed for that purpose ; and having been employed, during the last summer and autumn, upon that service, pursuant to your instructions, I beg leave to submit, for your consideration, the result of my surveys.

2. My first instructions were, to survey and examine part of one of the proposed routes, between Spencer and the east foot of the highlands, on the left bank of the outlet of Long Pond, in Worcester, a distance of more than twenty-two miles, and to ascertain the relative height, and quantity of water which could be obtained, from some of the ponds contemplated as reservoirs or feeders: to survey and examine, in like manner, the ground from the eastern foot of the ridge in Bolton, passing said ridge, and the valley of the Nashua River, in Lancaster, to Leominster line, being part of a second route contemplated for the canal. As these services were performed for the purpose of aiding you in the labours of the reconnoisances, which

we made together, last July, and, as I have heretofore communicated to the Board, the general results of those trials, in my various letters upon the subject, I presume no further details or observavations are desired now, and I shall, therefore, proceed to give an account of the line, which has been surveyed and levelled, between Boston Harbour and Connecticut River.

3. I proceeded first to Westminster, and began the surveys from that town to Connecticut River. The levels were commenced north of the village, by a brook which issues from Tophet Swamp; thence I ascended the brook, passed the swamp, and the ridge westward thereof, and followed the stream which unites with other waters, and fall into the Otter River. These streams are united above Bickford's mill, in Gardner, which I crossed at Meriam's Lathe, keeping round the foot of some high land on the right, passed the turnpike road by Tucker's house, in Gardner, and came to the Otter River, where it is the boundary between Gardner and Templeton, near the bridge; and thence the survey was taken along the valley of that stream to its junction with Miller's River, in Winchendon. From this point, the surveyed line was down the basin of that river to the Connecticut, in Montague.

4. As that part of this line, which passed over the high land, in Westminster, was supposed to be the most favourable for a summit level, by several gentlemen who had made trial levels, I next proceeded to carry a cross level, from the Upper Naukeag Pond, in Ashburnham, to Tophet Swamp, in Westminster, the distance about nine miles, with a view of ascertaining, whether that pond could be used as a feeder or reservoir. The height of the pond is 47.73 feet above the surface of Tophet

Swamp, at the east end, which I assumed, as the height, for the summit level, on that route.

5. I next began the survey of what is called the Ashburnham summit, commencing on the eastern side of the ridge, and carrying the level over to a meadow or swamp, near French's house, in Ashburnham, which was assumed as the height of the summit level on that line. Thence I followed low land, and the valley of a small stream, till I came upon the outlet of Mud Pond, and generally followed the brook, here called Miller's River, to Hyde's Bridge, in Winchendon, below Whitney's mills, at what is called the village. From Hyde's Bridge, the ground was represented as very favourable for a canal route, by leaving the valley of the river far on the right, and taking nearly a straight direction to Miller's River again, at the junction of the Otter with it, where this line falls into the former survey from Westminster.

6. Having gone thus far in the surveys, I proceeded to Westminster to explore a new route eastward, for that summit, through Princeton, Sterling, Boylston, Berlin, and Bolton, agreeably to your directions, and the observations derived from my view and examination, have been already communicated to the Board, and, of course, as yet, can make only a part of our united labours of the reconnoisances. While upon this duty, I left George R. Baldwin, the Assistant Engineer, to make the surveys, and take the levels of various ponds in the vicinity, which were considered important as reservoirs or feeders. We had been informed, by intelligent gentlemen, that there was, probably, through the valley of the swamp, which surrounds Mud Pond, a favourable route for a summit level, much lower than either the Ashburnham or Westminster summit; accordingly, I directed the As-

sistant Engineer, when he surveyed Mud Pond, to carry his level eastward, to ascertain the correctness of this information. The result was found to correspond with the representations which had been made, and I therefore continued the survey eastward, through this valley, and shall proceed to describe the route of a canal through Mud Pond as a summit level.

7. On the plans herewith presented, and which I request may be considered as a part of the report, are marked the entire route of the survey from Boston Harbour to Connecticut River; the streams which are to be met with, or crossed by the canal; some of the hills and valleys, and other natural obstructions; the course of the survey, denoted by a red line, and a profile of the whole route, exhibiting the general features of the country, over which the canal must be laid. In describing the line, and pointing out the facilities or difficulties, which will attend the construction of the work, I shall commence, first, with the summit level; second, describe the character of the western part of the route to Connecticut River; and, third, finish with a description of the eastern descent to Boston Harbour. On the profile, and in this report, the summit level is assumed, in all cases, where not otherwise designated, as co-incident with the surface of Mud Pond, which is 1065.84 feet above low water mark, in Boston Harbour, and 893.22 feet above the Connecticut, at the mouth of Miller's River.

SUMMIT LEVEL.

8. Mud Pond is situated in an extensive swamp, and its immediate margin consists of a soft, trembling bog. There is a small inlet, the sources of which are in the adjoining low ground, or come

from the meadow and swamp, near French's, and from the more elevated swamp, which forms part of the high ground on the Ashburnham level, as will be seen on the plan. The pond has a surface of 12 acres and 17 rods. From the pond, eastward, the survey was carried across the turnpike road, and in the swamp, part of the way along the brook, descending to the Nashua, about 130 chains, to the mouth of Adams Brook, where the level comes out at the surface of the meadow. The highest ground in this section is 9 feet above the pond, from which the descent either way is gradual.

9. From the west side of the pond, towards the north end, the outlet commences,—affording a constant, though small stream, and pursuing a meandering course, forms one of the head branches, in that vicinity, of Miller's River; and the level of the pond may be pursued about 110 chains, so that the summit pound may be about 3 miles in length, with no difficult or very expensive excavation. Some parts of the line exhibit rocks and hard ground, through the swamp, but there is no indication of ledge; and even a deeper cut, than the level of the pond, is to be preferred, if, on future trials, no greater difficulties are found, than can be discovered at the surface.

WESTERN DESCENT.

10. From the east end of Mud Pond, to the surface of Miller's River, at Cook's old dam, in 95.29 chains, the fall is 48.22 feet. Two or three points only, in this line, present difficulties, but the whole easily overcome. Thence, 90.47 chains to Pierce's Mill Pond, the fall is 18.92 feet. This line was carried behind Harris' house, for the sake of shortening the distance, but perhaps a more favourable,

though longer course, is to be had, between his house and the river. Some rocky and uneven ground, at the foot of high pasture, or hills, present themselves, but feasible land for a canal easily selected. The distance from Pierce's to surface of Whitney's Mill Pond, at the village in Winchendon, is 218.78 chains, with a fall of 48.43 feet. The most rapid part of this fall is in a short distance from Pierce's mill, through a rough, rocky ravine, at the foot of high land, on the left bank. But here nothing formidable is presented, and the rest of the line, principally through extensive meadow and swamp, is very feasible. Manomonack River from Rindge, comes in on the right as seen on the plan. From Whitney's Pond to the swamp on the left, and beyond Hyde's Bridge, the fall is 55.80 feet in a distance of 99.35 chains, the quickest part of the descent, being near the mills. A great portion of this section is along the foot, or side of steep, rocky hills, which project to the river's edge. From Hyde's Bridge the line takes a southwesterly course, through fields, meadows, swamps, or hard wood-land, to the brook leading to Dennis' Pond, at New Boston village, in Winchendon, 136.23 chains, with a fall of 64.45. Two or three high narrow ridges were encountered on the survey, as may be seen on the profile; but these may be avoided, and the general character of the surface is favourable for a canal. Leaving this brook, the course is nearly west, and crosses the road near Fry's house to the side hills forming the left bank of Miller's River, and thence the line is along the left bank, to the mouth of Otter River, over irregular, but very practicable ground, the fall being 14.40 feet in 153.80 chains. This section is very crooked, as may be seen by inspecting the plan, and I am convinced a much better route, in

all respects, is to be found, by keeping to the left, following the brook, and passing through, or along the margin of Dennis Pond, the outlet of which is at the west end, near Wales' Tavern, and falls into the river above the Otter. The pond is but little higher than the meadows on the borders of the river, though it was not surveyed. Instead of pursuing the course of Miller's River, from the mouth of the Otter to Furbush's, about a mile and a half below, a more eligible line was pointed out by several gentlemen well acquainted with the country, by leaving the river on the right bank, a little below the Turnpike, near the entrance of Priest's Brook, and keeping along low, level ground, nearly on a straight course to Furbush's, and thus keep Miller's River, in this section, far on the left. Should this line be found, on future trials, as favourable as represented, then the course of my survey from the Dennis Pond Brook to Miller's River, is nearly the right one.

11. The fall from the surface of Miller's River, at the mouth of the Otter, to the river opposite Furbush's House, is 1.85 feet, in a distance of 112. 66 chains. On this section the survey was carried along the left bank, generally near the edge of the river; and some short, steep, side hills coming to the water, are observed, but very practicable. From this last point, 146.64 chains to the top of Royalston Factory Dam, is a fall of 2.48 feet, over ground very favourable for a canal. There are one or two short places, where the bank of the river is steep to near the water's edge; and some skill will be required to lay the canal, judiciously, round the point of high ground by the Schoolhouse, and thence along the steep high bank, by the road, to the foot of the falls, below the Factory. This is, however, by no means forbidding. There

is a fall of 120.55 feet, in the distance of 222.37 chains, from Royalston Factory Dam, to the water of the river, at Lewis' Bridge. Upon the plan may be observed the crooked course of the survey, and the general character of the high lands, which, in many points, advance quite to the brink of the river. The gradual descent of the profile, shews that no great obstacle is met with, to be excavated; the only disadvantage consists in making the canal along the bank, where the hills come to the river; and the elevated, uneven character of the country, will render it indispensable to follow the meandering line of the stream. The bed of the river is generally covered with rocks, and the shores, except in a few patches of narrow bottom land, have the same character. From Lewis' Bridge to water of river 136.60 chains below, there is a fall of 42. 77 feet, and the high lands come, in many places, abruptly to the river. Generally, sufficient space is left along the foot of the hills, and in narrow bottoms to construct a canal. Points of ledges are sometimes seen, and in a few instances, the rocky banks, though not very high, rendered it most convenient in the survey, to take stations on large rocks in the river, near the edge. The same general character prevails in the next section, shores to the surface of Kendall's mills, in Athol. The shores are mostly, as in the two preceding sections, high and uneven, rising abruptly from the River, and covered with wood. In this distance of 168.10 chains, is a fall of 76.39 feet. The river rolls over a rough and rocky bed, which is generally indicative of the nature of the shores. Perpendicular ledges, or points of ledges are found at some places, which will not be troublesome to pass; or the level may be kept up, to pass above them, as they are not high. For most of the distance, however,

there is sufficient width of bottom land, or level ground at the foot of the hills, which range with variable distances from the river the whole way, to place the canal. The construction of a navigation from Kendall's Mill to Athol Factory, is easy, for the distance of 28.73 chains, with a fall 31.92 feet. A steep high bank, by the Factory Pond, will require extra cutting, but it consists of loose earth or gravel only.

12. In the next section, from Athol factory, to the surface of the river, at Young's bridge, 120.72 chains, there is a fall of 38.92 feet, and, although the line surveyed, is not, perhaps, the most favourable course, a canal may be constructed, with great ease. From Young's bridge, to Putnam's mill-pond, the fall is 0.50 feet, in a distance of 258.03 chains. The river must be passed, by an aqueduct, at, or near the bridge, and the rest of this line is very feasible. From Putnam's mills, to water of the river, by Hosley's bridge, the distance is 170.27 chains, and the fall, 14.78 feet. High, precipitous points of wood land, approach near the river, in one or two places, and the generally elevated character of the adjoining land, will not permit the location of a canal, far from the river; it must, therefore, have pretty much the same crooked course, which the stream presents. Otherwise, this section is quite practicable for a canal. Thence, to water of the river, as marked on the profile, in a distance of 164.04 chains, there is a fall of 27.14 feet, and many ledges, and steep banks, to the water's edge, are to be encountered, in making a canal. Similar difficult points occasionally occur in the next section, to Alexander's mill-pond, the distance being 115.30 chains, and the fall, 6.81 feet. But the general disposition of the shore is such, as presents few obstructions. Thence, the survey

was carried, most of the way, along the turnpike road, on the right bank of the river, 119.90 chains, to water of the river, which is 33.11 feet below Alexander's mill-pond. Some asperities of the line, are shown on the profile, near the beginning of this section, but no essential difficulty is found, except what is presented by the road, occupying the most favourable ground. The fall is rapid, and shows what must be the natural character of the stream, viz. rocky bed, broken, but uniform, current, and hard, rocky banks.

13. Thence to the river again, in Carter's land, a distance of 150.92 chains, is 71.54 feet fall; the next distance, to water of the river, is 111.43 chains, with a fall of 57.89 feet; and thence, to Gunn's bridge, the fall is 61.41 feet, in the distance of 106.73 chains. Over all the three last sections, more than $4\frac{1}{2}$ miles long, with a total fall of 190.84 feet, the same general hard features prevail, viz. steep banks, projecting to the river, in many places; perpendicular ledges, though not very high; rocky bed, with a noisy stream; high, uneven land, ranging along both shores; the river passing over ledges; and a very crooked line. Unfavourable as all these circumstances are, or may appear, on the plan and profile, there is no doubt as to the feasibility of a canal.

14. From Gunn's bridge, to top of Durkee's dam, at the mouth of Miller's, the fall is 35.77 feet, and thence, to the surface of the Connecticut, 19.12 feet. The whole distance, from the bridge to the Connecticut, being 144.15 chains. On account of the high lands, and the extensive bog, and wet swamp, on the right bank of Durkee's mill-pond, the course of the canal, like that of the river, must be circuitous, as represented on the plan. Perhaps, it may be found expedient, to bank across the bog, and swamp, by the pond, and thus, a much straighter

course obtained. The left bank of the Connecticut, as well as the mouth of Miller's River, below Durkee's dam, is composed of high, rough ledges, and a safe, well defended position, of the discharging locks, would be expensive. In other respects, this section has nothing unfavourable for a canal.

15. When the levels were terminated at the Connecticut, the surface, as taken in the calculation, was, on account of the extremely low state of the river, probably three or four feet below the top of the dam, at the locks, on that river, and all the water passed through the leaks, and fissures of the dam, and none entered the locks. The whole length of this western section, from the east end of Mud Pond, to the Connecticut, on the line of the survey, is 38 miles, 30.87 chains, and the fall, 893.22 feet.

16. Upon this division of canal, there are no deep valleys to pass, or high ridges to cut through, but the gradual fall of the basin, of Miller's River, must be followed. Hence, the descent is pretty uniform, the greatest declivity being from Royalston factory dam, to Young's bridge; and from Alexander's mills, to the mouth of the river. An inspection of the profile, will give an idea of the general character of the slope; and, except in a few places, where deviations can be made from the valley of the stream, the line must be kept, nearly, all the way, along the basin of the river.

EASTERN SECTION.

17. On the profile of the Eastern division, a very different character of the country is presented. Unlike the line westward from Mud Pond, which gradually slopes, the whole way, along the great valley of a river, this, in the greatest part of its

course, passes across the basins of several streams, and consequently greater obstacles are observed.

18. Beginning at the east end of Mud Pond, the survey was carried through the swamp, and by the brook, to the junction of Adams Brook, and thence following the valley of the stream, passing Burgis', Burrill's, Munroe's and Glazer's Lathe mill ponds, as marked on the plan, to Gross' mill dam, the distance is 313.05 chains, having a fall of 225.44 feet. The surface of the ground is generally rocky, and in some parts the water descends, in short distances, over cliffs and ledges, almost impassable for any thing but water. You will observe that in this short space, of nearly four miles, is found more than one fifth part of the whole fall, from the summit, to low water, in Boston Harbour. To construct a canal here, with equal and suitable spaces between the locks, will be attended with great difficulty. It may be found better and most advisable on further trials, to keep the canal up, passing Gross' mill, with a level, far above his pond, and drop into the valley of the brook, at some convenient point below.

19. From Gross' to Whitman's mill is a fall of 48.29 feet, in a distance 160.86 chains ; thence to Brooks' mill is 121.12 chains, and a fall of 60.39 feet ; thence to the guide-post by Bacon's House is 77.52 chains, falling 55.94 feet ; and from the guide-post, it is 82.56 chains to Farwell's mill, with a fall of 36.95 feet to his pond. The line of survey was generally carried along the meadows, swamps, or bottom land, on the immediate shores of this brook, which forms the north branch of the Nashua. Several steep banks and side hills, in short distances, must be encountered, and the stream must be crossed, or a new channel cut, which may easily be done, in the meadows, at some points.

But the ground may be considered favourable, for a canal, over all the distance, from Gross' to Farwell's mill, being a little more than 5½ miles, and having a fall of 201.57 feet.

20. Farwell's saw-mill is at the head of a cataract, falling over perpendicular cliffs and ledges, which constitute the bed and banks of the stream, and precipitating itself in noisy confusion down 70 or 80 feet, in a distance of a few rods, to meet and mingle with the other branch of the Nashua coming from Westminster. From the surface of this pond 29.41 chains, to the river, a few rods below the junction of the two branches, there is a fall of 89.74 feet, and the descent is along the steep, sideling declivity of high rocky land, consisting mostly of compact ledges. To gain this whole descent by locks, in so short a distance, would be attended with many inconveniences to the navigation, and the canal should be laid along the side hills, and extended, as it may be, to a considerable distance beyond the last point, before it drops to a level with the low ground on the left bank.

21. From the last named point on the river, to the road in Fitchburg, by Jewett's factory, which is 5.45 feet above the surface of his Factory Pond, there is a fall of 75.26 feet, in a distance of 200.13 chains. The mouth of Phillips' Brook, is passed on this line, which is kept along the left bank of the river, and as indicated on the profile has a pretty uniform descent. But it passes by a high, steep, gravelly bank, the foot of which is washed by the river, and must be turned round a high projecting point of ridge, to take the course to Fitchburg. In another place the river must be crossed, or the channel turned to avoid an inconvenient bend. This section, although hard rocky ground constitutes it, most of the soil is quite feasible.

22. From Fitchburg to the meadow, by Mashapaug Pond, is 446.13 chains, or a little more than 5.50 miles; and upon this section are found, as may be perceived by the profile, some of the principal difficulties to be encountered on the Eastern section. Hitherto the line has been gradually descending, and has fallen from Mud Pond 592.01, the distance to Fitchburg being a little more than $12\frac{1}{4}$ miles.

23. On leaving Fitchburg the survey was carried over very uneven ground, to the eastern edge of high woodland, as the profile shews, to where the ground is prètty level until it falls to Pearl Hill Brook. But a practicable, though more circuitous route, might be taken for this part of the line; and the real obstacles on this section of 5.50 miles, are the valley of Pearl Hill Brook, and Wilder's ridge. The fall to the brook from Fitchburg is 109.77. feet, and the highest part of the ridge 104.17 above the brook. The two high, narrow, steep, ridges, which in so singular a manner approach each other on the opposite sides of the valley of the brook, which is 14 rods wide between their bases, consist of coarse gravel, mixed with small stones. On the west side, the ridge is not more than 50 or 60 feet above the meadow, and that on the east is nearly of the same height. They seem admirably placed for abutments to an aqueduct 30 or 40 feet high, but to elevate one to the height of 60 or 70 feet, as is desirable, for piercing through Wilder's ridge, would be attended with expensive embankments, for a considerable distance, on each side the valley. No difficulty would attend erecting the aqueduct, and perhaps a repetition of the survey, might lead to the conviction that even an aqueduct, of sufficient height could be easily effected.

24. The reverse of all this is found at the ridge.

Not knowing how high a level should be carried through that barrier, I assumed one of thirty-five feet above the brook, and found the highest ground by Dr. Wilder's, to be 69.15 feet above it, and the meadow east of the ridge to be 77.35 feet higher than the brook, consequently 42.35 above the assumed level. If a line 60 feet above the brook is carried over the valley to the ridge, it would enter it on the west side, pass 44.17 feet below the most elevated point, and come out in the ravine by Goodrich's Old Mill, through which is the natural outlet of the meadow. The distance between these two points is about 66 chains, 33 of which would be through the meadow, at an average depth of 17 feet. The outlet from Onkeche walum Pond comes down from the left, and passes through the meadow, and would come easily into this level.

25. From Pearl Hill Brook, to the meadow by Mashapaug Pond, (which is 0.71 feet lower than the meadow,) is a fall of 6.52 feet. Thence, to the top of Edgarton's dam, at Shirley South Village, is 277.54 chains, or about $3\frac{1}{2}$ miles. On this line, is Goodrich's ridge, the highest point of which, is 46.33 feet above the Mashapaug meadow, on the west side, and the distance through the ridge, to low, sloping land, on the east side, is about 20 chains. From the foot of Goodrich's ridge, to Edgerton's dam, there are no impediments. The line, generally sloping, passes over the bogs which surround the Cattacoonemaug Pond, and the Mill Pond, below, over which, some inconvenience may attend the embanking for a canal. There is also a narrow, steep ridge, marked on the plan, at the head of the pond. The Mashapaug Pond, and the stream which issues from it, were not surveyed, but their positions, relative to the line of survey, are laid down sufficiently accurate, to show that the

canal may be carried through the outlet, instead of passing the ridge, should that course be found more eligible on future trials.

26. The distance from Edgarton's dam, to the Nashua River, at the surface of Staples' mill pond, is 180.77 chains; the fall to Longley's dam, is 13.21 feet, thence to the river, 46.70, making 59.91 feet descent, from Edgarton's to Staples' mill pond. A canal may be easily made on this line. The survey was carried along the level road, most of the way, on the edge of an extensive plain, on the right, and near the foot of high land on the left.

27. From the Nashua River, to the meadow and brook in Boxboro', marked on the plan and profile, the distance is 804.50 chains, or a little more than 10 miles, and the fall, 5.46 feet. This part of the route, passes through Shirley, Groton, Littleton, and Boxboro', and the few irregular points on the profile, have nothing difficult in executing a canal, except Woods Bar, which will require 15 or 20 feet cutting. By a judicious selection of the line, a canal, carried across the Nashua, about 20 feet above it; continuing the level to some point in the neighbourhood of Sandy Pond, and, on the south of it; then dropping by one lock, and thence, continuing the level through Woods Bar, would probably be most eligible. The highest point on the bar, is 33.90 feet above the Nashua. The meadow, at the head of Warren's mill pond, level with the water, is 0.65 feet below the Nashua. Sandy Pond and Bear Hill Brook, 3.67 below; low land, near the road, west of the brook 0.82 below. The water of Stone's saw-mill pond, on Sandy Pond Brook, is 7.53 feet above the Nashua; Sandy Pond 10.20, and Shaker's Brook, 3.58 feet above it. The highest ground, on the survey, is by the road near Nutting's, in the south part of Groton, being 30.99 feet,

and a stone, at the corner of his barn, is 28.25 feet above the Nashua. If a level of 20 feet, above the river, is preserved, through Woods Bar, it will require about 14 feet cutting there, and high embanking across the meadow and swamp, at the head of Warren's mill pond, as well as at some other points. I am inclined to think, that a lower level, across the Nashua, would be preferable, as the land between that stream, and the Sandy Pond and Bear Hill Brook, is more favourable to it, on the most direct course, and the extra cutting, by Nutting's, will be reduced, by going in north of his house and barn. This high ground extends but a few chains. The most favourable position for a canal, through this long section of 10 miles, however, can only be determined by repeating the surveys. The principal obstacles, you will perceive, are at the termini. Were it not for Woods Bar, all difficulty would disappear. I do not consider any obstructions met with, on this line, as very expensive, or discouraging, and most of it is extremely easy.

28. The distance, from the end of the last section, to Blanchard's, or Fort Pond Brook, is 227.20 chains, having a fall of 15.97 feet, and thence, to Elzebeth River, at Sherman's mill pond, a fall of 55.33 feet, in 166.82 chains, the whole fall being 71.30 feet, in a distance of nearly five miles. An inspection of the profile will show, as the ground exhibited on the survey, a favourable surface for a canal. It will be seen, that the line generally follows near Blanchard's Brook, and some skill will be required to lay the canal in the most advantageous position, relative to this stream. From the commencement of this section, the highest point, on the survey, is 2.15 feet, above the level, the top of the plain, at the brow of the steep hill, passing the left bank of the river, being 17.40 feet below the

level. No difficulty is found on this section. Some extra cutting, behind Hunt's house, and in the Conant Farm, in Acton, as well as embankments over the meadows, and across Fort Pond Brook, where the surveyed line crosses it, above Faulkner's mills, will be necessary. By a careful choice of the ground, 8 or 10 feet cutting, for short distances, and short embankments, for about the same heights, are all that will probably be required.

29. The head of Brown's swamp, on the north side of the road, east of Stratton's tavern, in Sudbury, is 164.89 chains, from Elzebeth River, and 44 feet above it. In this distance, of a little more than two miles, the ground is very irregular. The line passes the fork of the roads, near the corner boundary of Concord, Sudbury, and Acton, where the ground is 67.09 above the river. Thence, crossing a narrow meadow and brook, the survey was carried along Hayward's ridge, east of the road, then crossing the road, and coming into it again, in front of Dakin's house. From this point, the line was carried along the road, having a steep side hill on the right, and low meadow, and brook, on the left, for 20 or 30 rods, when it rises to the highest point, near the cooper's shop, behind Col. Adams' house, which is 76.54 feet above the river, thence it descends into Adams' swamp, which is 66.95 feet higher than the Elzebeth. Some ground, in the field behind Stratton's tavern, is 4 or 5 feet above Adams' swamp, for a short distance; but, passing to the south of the road, and afterwards crossing to the north, and falling into Brown's swamp, the ground is below the Adams' swamp. To get over this section of the line, an aqueduct must be elevated, about 50 feet, above the river, on account of the deep cutting behind Col. Adams' house, and through his swamp, the length of which, would be about 54 chains. A

level of 50 feet, would require excavation, in Adams' swamp, of nearly 17 feet depth. Were it not for deep cutting, on this part of the line, a level of only forty feet above the river, would be more eligible, notwithstanding the increased depth of digging, for a short distance, at the fork of the roads.

30. From the head of Brown's swamp, the water runs to Concord River, and it is nearly in the basin of this brook, the survey was carried to Concord River, 195.79 chains, the fall to that stream, being 69.47 feet. No obstruction is observed on the profile, and none was found on the survey, although on repeating the levels, a better route may be selected, than is presented on the plan. It will be seen, however, that the next section, east of Concord River, must influence the position of this, and, probably, render it necessary to seek an entirely new course here.

31. Upon the next section, the survey was carried, from Concord River, over the high land, which divides the water of that stream, from those which run into the Charles, to an elm, on the left bank of Stony Brook, nearly in front of Mr. Fiske's store, in Weston, the distance being 369.45 chains, or a little more than 4 miles, and the bench on the elm, 5.91 feet above the Concord. On crossing the river, about half a mile above Lee's bridge, the survey was taken round the foot of high wood-land, on the north side, thence, towards Farrar's house, at the head of the meadow, 90.79 chains, where the ground is 15.98 feet above the river. At the bridge, in the road near Farrar's, the height is 44.48 above the Concord. The line was thence carried through Farrar's and Jones' meadow, 47 feet above the level, and on through a little patch, called Pond Meadow, to the foot of the high ground, called Hagar's Ridge, where the height is 53.42 feet; and

thence, to the highest point of the ridge, 83.19 feet above the river. The distance from the head of the first meadow, below Farrar's, to the top of this high ground, is 62.28 chains. From the ridge, passing over plain fields, on a gentle descent, and crossing the road, by Daniel Hagar's house, to a large pine tree, in Bigelow's swamp, (being part of a large tract of low land, extending to the south, called Abbot's swamp,) the fall is 16.13 feet, this point being 67.06 above the river. Distance 38.15 chains. Passing a piece of low upland, and through the outlet of the swamp, the water of which constitutes one of the principal sources of Stony Brook, thence down the meadow of this stream, 66.44 chains, to a bench on a maple, the fall from the ridge is 48.88 feet, and the bench, 34.31 above the river. From this point, the survey was carried 111.79 chains, along the meadow, or low land, through which Stony Brook meanders, descending, gradually, to a bench on the elm tree, before mentioned. The bench being 5.91 feet above Concord River; and 6.10 above the water of the brook, at the foot of the bank.

32. This section presents a troublesome barrier to pass, on account of the extensive low land on the left bank of Concord River, compared with that I have just described; and together with Wilder's ridge, the valley of Pearl Hill Brook, and perhaps the high ground by Col. Adams' in Acton, constitute the only obstacles to an easy execution of a canal. Supposing a level to be carried across the river 30 feet above it, the direction would necessarily be different from the surveyed line, and it would enter the ground near Farrar's, and be 14.48. feet below the bridge before named, and it would come out near the bench on a maple referred to above, in a distance of 159.21 chains, or about 2

miles. An average depth of cutting, on the west side of the ridge, of 17.82 feet, for 38.09 chains ; and a like depth of 15.78 feet for a length of 50.05 chains on the east, would reduce, what might be called deep digging, to a distance of less than a mile, the deepest part being 53.19 feet. A tunnel might be found preferable, for a short distance.

33. But the land over which the survey was brought to the river, on the west side, is not favourable for a level 30 feet above the stream. It is for a considerable distance too low. Even a level 20 feet high, would require long, though not elevated, embankments. The country, as viewed on the survey, was higher on the left as it approached the river, and it appears very probable, that a line may be preserved high enough to cross the river 30 feet above it, by keeping more to the north and near the road, so as to cross at or near Lee's Bridge, which is the only favourable place, except on the surveyed line, for passing the river, in that neighbourhood. There can be no doubt, that Lee's Bridge offers the best ground for a high level, and if an aqueduct 40 feet above the river is attainable, even with considerable embankment west of it, the passage through Hagar's ridge would be of little moment, in a work of this magnitude and importance.

34. As I had not the pleasure of accompanying you, in the exploration of this line, east of Concord River, the result of the observations made by the Commissioners, was communicated by Gen. Dearborn, in a letter, which he favoured me with, on your behalf. In that he suggested the probability of finding a nearer route to Waltham Plain, on the Charles River, in that vicinity, than to follow the Stony Brook to its mouth, and then down the Charles. His instructions were, to leave the valley

of the brook on the right, somewhere near Messrs. Hobbs' in Weston, and cross over by Dr. Hagar's, and descend to the plains near the School-house by Col. Townsend's.

35. Pursuant to these intimations, I assumed the bench on the elm which terminates the preceding section, as a level, and carried the survey along the side hill, which forms the left bank of Stony Brook,—passed behind Messrs. Hobbs' House, over the meadow, through which a brook from the north, falls into Stony Brook; then rising and keeping round the foot of Nathan Hobbs' Hill; going over elevated land, and after crossing Hagar's Meadow and the road, ascended to the highest ground north of the road; and then descended rapidly to a bench on the root of a great elm, on the north side of the road, by the School-house, near Col. Townsend's, on Waltham Plain. The whole distance being 239.10 chains, or very nearly 3 miles, with a fall of 50.16 feet.

36. On leaving the elm by Fiske's Store, the side hill with variable slopes, discovers some ledges, but nothing difficult occurs. Behind Messrs. Hobbs' house, the ground is very broken and irregular, for a few chains. The meadow south-east of their house, would require an embankment of an average height of about 15 feet, for the distance of 20 chains, the deepest part being 25.17, below level. The line, round the south foot of Nathan Hobbs' Hill, will pass over uneven and rocky ground, with loose ledge, but nothing important occurs till we reach a narrow deep meadow of Dr. Hagar's. Here an embankment from 18 to 20 feet high will be required, and 7 chains in length. This, however, may be avoided in a great measure, by turning round on the left, though this is the most direct and preferable course. Thence cross-

ing the road, which is nearly level, the ground gradually rises to the highest point, which is 16.03 feet above level, which comes out again at 30 chains from the road, thus giving an average depth of cutting, of a little more than 10 feet for that distance. From the last point the only question is a practical one, how to place the locks, to descend to Waltham Plain.

37. The remaining part of the survey, will not require any particular description, as the construction of a canal is most obviously, easy and convenient. The distance on the surveyed line, from the elm tree near the school-house, on Waltham plain, to the point where the survey terminated on the Marsh in Boston, east side of the old dike, near the Boston Cordage Manufactory, is 732.38 chains or nearly 10 miles. The fall from the bench on the elm, to the Marsh, is 60.22 feet, and adding 10 feet, as I have done, upon the supposition that such would be the descent to low tide, the fall is 70.22 to low water mark in Boston Harbour. The course of the survey is clearly indicated on the plan, but the line there presented is by no means eligible. It was thought sufficient to extend the trial level to Boston, in the most convenient direction, as the practicability of the work is manifest here, without selecting the most expedient route for a canal. The determination of this question depends upon many considerations. Charles River must be crossed either by an aqueduct, or over some of the ponds at the factories, and whether the canal should be carried across the plain to the river, and thence continued along the left bank, by the numerous and important factories and mills, through the village of Watertown, and carried over to the right bank below the town, can best be determined by repeated trials.

38. I shall add only a few remarks relative to the position of this section of the canal, especially that part which extends eastward, from the head of Waltham Plain. The canal ought to terminate in a capacious basin, east of Washington-Street in Boston, where the communication may be easy between sea vessels and canal boats, so that their cargoes may be loaded and unloaded, into each other. To effect this, an inclosure with lock gates should be formed, for the admission of ships or smaller vessels, to the surface of the basin, kept nearly on the same constant level. From this there may be a canal extended across Wheeler's Point, and around by the ship yards and lumber wharves, towards India wharf. Another may be carried from the basin, across Washington Street, and along the foot of the Common, on the site of the old Rope-walks, to West Boston, or even to Craige's Bridge. The importance of such a disposition will appear, when it is considered, that the use of a canal, near the Capital, will depend upon the facilities, with which it can be employed, compared with those of ordinary land carriage. To induce those, within a few miles of town, who have occasion to transport great and numerous loads, to use the canal, in preference to wagons, all the accommodations of navigation must be pushed, as near as possible, to the centre of business in Boston, and conducted through, or as near as possible to, the villages and manufacturing establishments in the vicinity. Thus, by crossing the plain, in Waltham, dropping down to the left bank of Charles River, by the upper Waltham factory, following the left bank, by the lower factory, by Bemis' mills and factory, continuing along the village and mills in Watertown and crossing the river to the right bank, at the bridge or a little below, all

these thriving and important points will be accommodated. After passing to the right bank, the continuance and direction of the canal will be influenced by careful examinations of the country over which it can be laid. If a line can be found, conveniently practicable, near the village of Brighton thence to the foot of the high lands in Roxbury, near where the Punch-bowl road leaves the great Marsh, and thence over the low, level ground to the neck at Washington Street, where the end of the survey is shown on the plan, such a line will be preferable to that which was followed on the survey. But this becomes doubly interesting in another point of view, in which I shall venture to place the subject.

39. The City of Boston has recently turned its attention to the important question, of supplying the town with fresh water. A report has been made upon the subject by Mr. Treadwell, in which he points out two modes of effecting the object; one, by pipes from Spot Pond in Stoneham, which is high enough for all purposes without the use of forcing pumps; the other, by trunks, to conduct water from Charles River, above the Dam and tide water at Watertown, to the Mill-dam in Boston, whence it is proposed to pump it to elevated reservoirs, in different parts of the town. But the supply by a canal for all uses, may be effected, and thus the City of Boston become interested in a work which will serve for navigation as well as supplying the inhabitants with abundance of water, at all times. The estimated expense of leading the requisite quantity, by trunks, from Watertown is $ 84,008, which would probably be fully adequate to the expense of constructing the canal from Watertown to Washington Street, in Boston. From the canal the water may be conducted by a

trunk or pipe, to a basin near the pumps, where it might be left to deposite any impurities it may have received in its way, and pass perfectly clear to the working pumps. Upon this scheme, the cutting through marsh land must be avoided as the water would probably, for a while, imbibe too much saline matter. Some modifications in the dimensions and mode of constructing the canal would perhaps be advisable, in order to continue the supply in winter; and it may also be expedient to adapt the level, where the canal crosses the Charles River, at Watertown to a height suitable and convenient for both purposes.

40. In either of the modes, contemplated by Mr. Treadwell, for obtaining a copious supply, the expense of reservoirs, mains, and distributing pipes, in town, will necessarily be much alike; and the cost of building, and keeping pumps, &c. in repair, will be the same, whatever may be the plan for bringing water to them. The trunks, whether of wood or iron, which are proposed for the mains, from Watertown, would be a dead loss of capital, amounting to $84,000; but, by subscribing that sum, in the stock, and taking a much larger amount, the town would receive an income, upon their capital, together with all the advantages, resulting from a supply of water.

41. Instead of constructing a small basin for boats, at the termination of the canal, it is important to consider the expediency of building a dam, from Wheeler's Point, to South Boston, and thus, forming a full basin, in addition to that already obtained by the Boston and Roxbury Mill Corporation, as was originally contemplated by that company. An immense acquisition of mill power, would thus be created, beyond what would be necessary for the pumps, and no occasion has been presented, where

the immediate pecuniary interests of the City and Mill Corporations, could be more extensively promoted. If the canals of fresh water are made to pass round the west side of the town, and on the east, as far as can be found expedient, in the manner before suggested, this circumstance alone, will be a fortunate one, on account of fires, besides the beautiful termination, which the canal would give at the foot of the Common, if its banks are planted with trees, and formed into promenades. The whole appears feasible, and seldom has a plan of internal improvements been proposed, where a peculiar, local object of so high importance to the capital, could be brought in, to harmonize with the remote interests of the State. All the advantages, to be derived from an active navigation on the canal, will be mutual, between the town and the wide district, through which it would pass; but when the furnishing an ample supply of water, to the city, is taken into view, the high degree of interest which animates the whole country, from Boston to Connecticut River, towards a navigable canal, must be felt in town with an increased force, resulting from the incalculable advantages the corporation, and every householder in the city, will derive from the combination of two such objects.

DIMENSIONS OF LOCKS AND CANAL.

42. The scale of navigation, must be graduated from the size of the locks, and I would recommend making them 14 feet wide, and 80 feet long, in the clear, so that a boat, from 60 to 80 feet in length, and 13 or 13 feet six inches wide, will easily pass. The canal to be 28 feet wide, at the bottom, 5 feet deep, and 43 feet wide, at the surface of the water. A navigation, of these dimensions, is better suited

to the various kinds of traffic, which will be carried upon it, than a small canal. There is, perhaps, no predominant article of trade, to which the scale of navigation ought to be exclusively adapted, or which can even be said, at present, to claim particular attention, and, should there arise one hereafter, a great canal is, on all accounts, preferable to a small one. If coal, stone, iron, or other heavy minerals, were the only objects of transportation, it might be thought advisable, by some, to construct a canal, on a smaller scale, especially if the topographical, and hydrographical nature of the country, presented serious impediments to the execution of a large one. But these articles will, probably, constitute only a small part of the trade. Various kinds of lumber; manufactured goods, either of wood, or other light materials; cotton, and the various manufactures depending upon it; merchandise of every kind; and all the great variety of agricultural products; these will constitute a large portion of the trade, but can never be profitably transported in boats of small size, on account of their bulk, and the space which is generally lost in the lading.

43. A second consideration is, that the extent of the lockage, will necessarily occasion a great loss of time, on any scale of navigation, and by the use of large boats, fully loaded, nearly half this time may, probably, be saved. A third reason, for adopting locks of this size, and one which is, certainly, deserving of attention, is, that should a canal be effected, to the Connecticut River, the time will, doubtless, soon arrive, when an extension of this important line of inland navigation will be made to the Hudson, and thus the Erie Canal connnected with ours. In that case, a navigation, fitted to an easy, and advantageous intercourse, by boats of

both canals, would be of the highest importance; for which purpose, it may be best to make the locks 90 feet long, that being the length of locks on the Erie canal, instead of 80, which is above given.

RESERVOIRS, FEEDERS, AND SUPPLY OF WATER.

44 The first, and most essential, inquiry to be made, in settling a question of the practicability of making a canal, is the quantity of water which can be furnished, and it is to be regretted, that more time has not been allowed, for gauging the sources, and collecting facts, upon this most important point. Enough, however, has been done, as I believe, to satisfy the Commissioners, that an abundant supply is attainable, and I have, therefore, had no hesitation, in recommending the scale of navigation, as stated above.

45. The following ponds have been carefully surveyed, and their surfaces cast, at the lowest summer level, and their areas, with their relative heights, compared with the assumed level of Mud Pond, are noted below.

				A.	R.
Mud Pond, called the summit level, contains	-	-	-	12	17
Upper Naukeag,	63.35 feet above Mud Pond	-	-	286	48
Wattatick Pond	84.58	do.	do.	27	145
East Pond	45.56	do.	do.	16	19
Lower Naukeag	00.43	do.	do.	208	134
Gardner Pond	27.24	do.	do.	139	12
Westminster Pond is	37.35	feet	below,		
and contains		-	-	152	100

The five first, have an area 601¼ acres, and the streams issuing from them, were gauged, on the 13th and 14th of October last, when the discharges

were uncommonly low, and after a long period of dry weather. Wattatick discharges into East Pond, and from the latter, the water flows down Phillip's Brook, and enters the Nashua, a little above Fitchburg. Upper Naukeag flows into the lower Naukeag, from which a copious stream passes, to the west, and forms a leading branch of Miller's River. The outlet, from Mud Pond, takes a north-west, direction, and after running about $1\frac{1}{2}$ miles, unites with the stream from the Lower Naukeag.

46. On measuring the water issuing from East Pond, being the united waters of that and Wattatick Ponds, it was found to discharge, in 24 hours, 125,880 cubic feet; the united waters of Upper and Lower Naukeag Ponds, as measured at the outlet of the latter, 469,815 cubic feet, and the discharge from Mud Pond, taken near the road, was 53,913 cubic feet.—The aggregate is as follows.

Wattatick and East Ponds,	125,880 cubic feet.
Upper and Lower Naukeags,	469,815 do.
Mud Pond,	53,913 do.
Total of the 5 ponds,	649,608 do.

As this quantity is what naturally issues in an unusually dry season, no deduction for waste or evaporation need be made, and the only deficit which can arise from these causes, will be in the feeders or ditches, which convey the water to the summit. The summit level itself will be sunk deep enough to be on a level with Mud Pond, and I would recommend dropping it as much lower, as shall be found practicable; and as the nature of the soil, and the whole structure of country in this district, already supplying Mud Pond, will furnish abundant reparation for any loss by absorption; and as the

evaporation which takes place from the surface of Mud Pond, is probably equal to what would arise from the surface of the summit level, 43 feet wide, and about 3 miles long, a very small allowance for either evaporation or absorption can be required.

47. Upon these considerations, the following view of the subject will, probably be satisfactory to the Commissioners. A lock 80 feet long, 14 feet wide, with a supposed lift of 8 feet, will contain 8960, or call it 9000 cubic feet. The actual discharge in a very unfavourable state of the season, as given above, will furnish 72 locks full per day. Allowing half this quantity for waste at the gates, loss by evaporation, &c. there remains 36, and supposing a lock of water discharged out of the summit at each end, by the passage of 1 boat, 18 boats may be navigated through the summit level, per day, with the supply as found above. Supposing the average tonnage of a boat to be 30 tons; 220 days of free navigation in the year; 3 cents a ton toll, per mile; and the canal to be, as it very nearly will be, 100 miles long, the traffic will give $356,400 income, a little short of the interest of $6,000,000.

48. But this view of the question is far too limited as to the supply. We ought to consider, also, the advantages to be derived from reservoirs, so that, while in the early part of the season the natural supply of water is sufficient for an extensive trade on the canal, the same scale of business may be continued, through the dry months, by drawing from artificial resources. The means of constructing and filling reservoirs are abundant. I shall only consider now the five ponds before named.

49. The area of Upper Naukeag taken at a very low water mark, is 286 acres. By embanking, not

very high round some parts, this pond may be flowed 10 feet above its lowest state; the outlet may be deepened so as to draw down 10 feet below the actual low water level, and thus a basin 20 feet deep, with an area of 286 acres, obtained, giving 249,163,200 cubic feet of water. Rejecting a quarter for waste, evaporation, &c. the remainder will furnish for about 150 days, double the quantity per day, which I have before shown, was the aggregate daily discharge of the five ponds, during the dry season.

50. Lower Naukeag has an area of 208 acres. It may easily be raised 6 feet, and the feeder from it sunk to any convenient depth, to which the summit level may be carried, which I shall suppose 8 or 9 feet. This pond may be converted therefore into a reservoir 10 feet deep, that is, the surface 6 feet above, and bottom 4 below, the actual measured area, and it will contain 90,604,800 cubic feet.

51. East Pond has an area of 66 acres, and may be flowed so as to give a reservoir at least 10 feet deep, containing 28,749,600 feet of water.

52. Wattatick Pond, may also be flowed 10 feet, and as it has an area of 27 acres, it will hold in reserve 11,761,200 cubic feet. Mud Pond may also be made a reservoir, but at present, I consider it only as furnishing the daily loss by evaporation, &c. on the summit level.

53. The four ponds first named will be considerably reduced in the areas, when they come to be drawn below their present level, but I have also considered, that the areas will be very much enlarged, by flowing to the supposed height when full, and I think it safe to take, as I have done, for the mean areas, those given by the surveys. The total amount, in cubic contents, will be then, as follows:

Upper Naukeag - -	249.163.200
Lower Naukeag - -	90.604.800
East Pond - - - -	28.749.600
Wattatick - - - -	11.761.200
Total of the four reservoirs at the summit	380.278.800 cubic feet.

54. The prism of water, in the canal, will for each mile, be 937.200 cubic feet, and taking it 100 miles long, the whole canal will contain 93.720.000 feet. The surface, 43 feet wide, will be for each mile 5.212 acres, or 521.20 acres in the whole. The united surfaces of the 4 ponds and canal will be 1110 acres, and supposing a loss by evaporation of 3 feet in depth, the allowance on this account will be 48.351.600 cubic feet; and double that quantity for waste by absorption, &c. in the canal and feeders, the deduction to be made from the contents of the reservoirs is 145.054.800, leaving for the navigation a little more than 235.000.000 cubic feet. This quantity of water can be thrown into the summit level, so as to facilitate the passage of 56 boats through it daily, during 220 days of the year, in the same manner I have before attempted to shew, that 18 boats loaded with 30 tons each, may pass, with only the scanty supply of the natural outlets of the ponds, in a very dry season.

55. In allowing 3 feet depth for the loss by evaporation, it has not been overlooked that a great compensation will naturally be made by rains, so that probably not more than half that amount will actually be lost from that cause. But wishing to place the question of supply on the most satisfactory footing, which the circumstances would allow, I have calculated the whole deficit, wasted from the surface, at more than 48.000.000 cubic feet. Other facts may be stated as having an important

influence in the case. Adams Brook represented on the plan, may be discharged into the summit near the eastern end, and has not yet been taken into the account. It has various sources, in different parts of the swamp before described. On making a cross level from Upper Naukeag to the Westminster level, the line was carried over a little mill pond, where Richardson's lathe is worked by it, near the head of one branch of this brook. It is 60.63 feet above Mud Pond, and here an extensive reservoir may be constructed. Independent of which, the brook furnishes a constant stream, in the dry months, and would add greatly to the quantity, which can be turned into the summit.

56. An equal distribution of water from the crown level, will not be required, in the two descents from it; the east part of the line will require the greatest share, on account of its greater length and lockage, the nature of the soil over which it will be made, and the great fall from the summit, to new supplies. Over nearly the whole distance from Mud Pond to Connecticut River, the western section of the canal will necessarily be laid along the valley of Miller's River, and, in many parts, very near the river itself. No high plains, or gravelly soil will be encountered, and the absorption, if the work is well constructed, will be reduced to the minimum for such undertakings, Besides, Miller's River, at almost any point, from its source to its mouth, may be turned into the canal, by dams, together with what water it receives from springs and brooks, in the intermediate distances. There are, in addition, four large streams or rivers, from which, and from reservoirs to be constructed near their sources, vast quantities of water may be taken or secured, to feed the canal. These are the Manomonack River, Priest's Brook.

Otter River, and Tully Brook. Numerous smaller rivulets are omitted.

57. Manomonack River has its rise in three large ponds in Rindge, called Manomonack, Emerson and Perley Ponds. This stream falls into Miller's River above the mills at the village in Winchendon, and all its water may be taken into the canal at about 100 feet below the summit. Neither the ponds in Rindge, nor the streams issuing from them have been gauged or surveyed; the information derived from correct sources, justifies the belief that a very great supply may be constantly taken into the canal from the brook, and capacious reservoirs formed at its sources, or in its basin.

58. At about 240 feet below the summit level, Priest's Brook may be admitted. It falls into Miller's River on the right bank, south of the Turnpike in Winchendon, a mile west of Wales' Tavern. There is a saw mill at its mouth, and although a small stream, is constant, and would furnish a very considerable feeder.

59. Next is the Otter River. A survey from Westminster was first carried down the principal branches of this stream, and after passing the outlet of Gardner Pond, the survey fell into the basin of this river, and crossed it in Gardner. The surface of the water at the junction of Otter and Miller's River is 250.22 feet below Mud Pond. The facilities which would attend the construction of reservoirs, in many places, along the extensive basins of this, and its tributary streams, are great; and independent of the constant, natural supply of the Otter, resources could be held in reserve to a large amount.

60. Gardner Pond discharges its water into Otter River, and had an area of 139 acres, in its very low state, when surveyed, and is 27.24 feet above

the summit. It can be flowed in winter and spring, so as to make a reservoir 20 feet deep; which, with an average area of 139 acres, will contain more than 121 millions cubic feet of water; that is, more than sufficient to fill the whole canal from one end to the other.

61. Descending to the meadows, below the factories in Athol, a very important acquisition is made to miller's River, by Tully Brook, which comes in from the northwest, and delivers a great quantity of water. The surface of Miller's River, at Young's Bridge, about half a mile below Tully Brook, is 565. feet below the summit, and therefore this brook can be taken in, at a few feet above that level.

62. Hitherto we have only considered the natural discharge of the five ponds which can be turned into the summit level, in a very dry time, and what could be retained in reservoirs to supply the canal during the lowest state of the streams. But for a great part of the eight months, during which the navigation would be open, there would be discharged copious streams, after the ponds are filled, from the brooks and springs which flow into them. With this natural supply, the navigation would be, without doubt, supported for five or six months in common years, and thus leave the estimated amount in the reservoirs, as before shewn, to be used only during the two or three other months of drought.

63. Ward Brook springs from Rindge and Ashburnham, and after passing over a long tract of low land, meadows, and swamps, receiving into its basin the rain and melted snows from a great extent of hilly country, enters the Lower Naukeag Pond on the east side, a little north of the brook which comes from Upper Naukeag.

64. Another copious stream from the north, called Bluefield Brook, having nearly a similar course, unites with the outlet of Lower Naukeag, below Bennet's mills. During the rainy season, or when the water of Ward Brook is very high, the floods cover the meadows, and part of the water flows off by a brook to the westward, and falls into the Bluefield, about 3 or 4 miles above its mouth. All the water which thus escapes in freshes, from Ward to Bluefield Brook, may be kept in its natural basin, and turned into Lower Naukeag, thence to the summit level, and of course sent down the eastern descent, instead of being uselessly wasted in its original course down Miller's River. I was informed, by gentlemen well acquainted with that country, that Bluefield Brook itself may be easily turned into the Lower Naukeag, and the same disposition made of it as Ward Brook.

65. On the eastern descent from the summit to Boston, many additional feeders may be taken in, to supply any deficiency which can be supposed to arise, in the quantity receivable into the crown level. The East Pond in Ashburnham is high enough to flow into the highest point, but should it be found embarrassing or expensive to lay a feeder sufficiently high for that purpose, it may be turned into the canal at some lower point above Gross' mill Pond, or, at very little cost, be made to unite with the brook falling into that pond, and which comes from the north. This is represented on the plan, upon the route called the Ashburnham level.

66. At 273.73 feet below the summit level, Beach Hill Brook, from Westminster, comes into Whitman's mill pond. The brook, from Tophet Swamp, in Westminster, falls into this branch of the Nashua, on the right bank, nearly opposite

Bacon's house, by the guide-post, in Westminster, and can be admitted into the canal, at about 400 feet under the summit. These are both considerable streams, and pour down, in winter and spring, vast quantities of water, and, besides their usual supply, at all seasons, would fill extensive reservoirs, for the construction of which, favourable sites could, undoubtedly, be selected. Some intermediate brooks, as noticed on the plan, are admissible into the canal.

67. The next, and most copious supply, perhaps, on this whole section, is to be had from the branch of the Nashua, which comes from the south, and unites with this, below Farwell's mill, in Fitchburg. The principal sources of this stream, are in the Wachusett and Westminster Ponds. The former was not surveyed. Westminster Pond is 37.35 feet below the summit, at Mud Pond, and is found, on the survey, to have a surface of more than 152 acres. It can be converted into a reservoir, 20 feet deep, and would thus contain upwards of 132,000,000 cubic feet of water. What are the characters of other smaller brooks, which combine with this river, before it reaches the line of the canal, and what are the facilities of forming reservoirs, I cannot say, as I have not examined it, but there can be no doubt, that many valuable acquisitions are attainable, along the basin of so large a stream.

68. The mouth of Phillip's Brook, is 544.65 feet below the summit, and can be taken in, at any level which it may be found convenient to give the canal, at that place. The head source, is in the East Pond, in Ashburnham, from which, the water flows to the Nashua, generally, in the bottom of a deep narrow ravine, with no considerable, or extensive, tributary brooks, but many rills and springs on the way. Several mills, or small factories, are on this

stream. By a dam, across the Nashua, below Farwell's mill, and one on the Phillips Brook, the water of these two streams, if required, may be thrown into the canal, and is the last place for receiving a feeder, until the line reaches the water of the Onkeche Walum Pond, east of Wilder's ridge.

69. On descending eastward, from this ridge, the surveyed line, falls into a meadow, through which passes the Onkeche Walum Pond, situated in Lunenburg, about one third of a mile on the left, and represented as fifty or sixty feet above the meadow, having a mill at its outlet. The meadow is 621.51 below the summit, and the water flows from it to Mashapaug Pond, then through the Cattacoonemaug, and Edgarton's mill pond, and, finally, falls into the Nashua, about a mile above the line on which the survey crosses that river.

70. Edgarton's dam, at Shirley village, is 789.23 feet below Mud Pond, and is, perhaps, the best pond to feed from, after taking the water of Walum Pond Mashapaug Pond, may be used as a reservoir; but, if flowed much above its present level, a great extent of meadow, bog, and swamp land, will be covered; and by deepening the outlet, and drawing down the water, this pond might serve as an equalizing reservoir, to receive any occasional redundancy of water, sent down, from some higher level, when not wanted in the lower part of the line. After passing Goodrich's ridge, or the outlet, if the canal goes that way, the water of the pond may be admitted into the canal. The Cattacoonemaug is a small pond, surrounded by soft bogs, if and flowed a few feet, a great extent of swamp would be covered. It is 12.46 feet, above the top of Edgarton's dam, and, if it should be found necessary, this water may be taken in, before reaching Shirley village.

71. The next stream, which can be admitted into

the canal, on the surveyed line, is Shaker's Brook, which is the boundary line, between Groton and Littletown, at the place where the survey passes it, and, at that point, is 845.56 below the summit, and 7.74 feet above Spectacle Pond, which receives this water, and which is situated 47.38 chains on the left, in a north-easterly direction. From Spectacle Pond, the water flows into Forge Pond, in Westford; thence, the stream takes the name of Stony Brook, and discharges into the Merrimack, about two miles above the mouth of Middlesex canal.

72. Sandy Pond, in the south part of Groton, is about a quarter of a mile to the north, on the left of the survey. It is 838.94 below the summit; 10.20 feet above the Nashua, and 14.36 above Spectacle Pond.

73. Long Pond is situated at a small distance north of Sandy Pond, discharges its water into, and is represented as considerably higher than, the latter. The water of this and Sandy Pond may both be turned into the canal, and as, during the spring floods, part of the water of both flows into Spectacle Pond, it may be found very easy to take the canal through, or along side of Sandy Pond, and thus both be made tributary to the navigation.

74. Between Shaker's brook and Woods' Bar, the cutting would pass through some meadows, the springs of which, now constituting the head water of a brook falling into Warren's mill Pond in Littleton, might be taken into the canal; but on account of Woods' Bar, the level must be kept too high for the admission of that pond, which is 850. 05, and Beaver Brook coming down from the south and crossed by the survey, 845.73 feet below the summit.

75. From the eastern side of Woods' Bar the

water flows through a long tract of meadow land, in a crooked course, and is called Blanchard's Brook, until it unites with Fort Pond Brook, in Boxboro', near the line of Acton, by Raymond's house; it then retains the name of the last mentioned brook, and after receiving two or three other small streams, passes to Faulkner's mill pond, in Acton. The water of these rivulets, may conveniently be turned into the canal. A great quantity of water, may, in addition, be retained in the Long Pond, and Fort Pond, in Littleton, which constitute the head of Fort Pond Brook, before mentioned. Long Pond, is about 2 miles on the left of the surveyed line, is 813.94 feet below the summit, and although not accurately surveyed, contains about 86 acres. It discharges into Fort Pond, and thence passes as before described, to Faulkner's mills.

76. After passing Fort Pond Brook, no water can be admitted in the course of the canal, excepting Stony Brook, in Weston. A constant, though small acquisition is attainable here; but reservoirs may be obtained to a great extent, near the head waters of this stream, and in Shakers' Pond, &c. in Harvard, which is the source of Shakers' Brook.

77. Such are the sources of supply, independent of the reservoirs, which are found on the line of the canal, and which may be admitted into it, with little expense. The quantity of water, which may be retained in the reservoirs, before named, that is Upper Naukeag, Lower Naukeag, East, Wattatick, Gardner, and Westminster Ponds, are as follows.

	CUBIC FEET.
Upper Naukeag Pond, 286 acres, 20 feet deep, - - - - -	249,163,200
Lower Naukeag Pond, 208 acres, 10 feet deep, - - - - -	90,604,800
East Pond, 66 acres, 10 feet deep,	28,749,600
Wattatick Pond, 27 acres, 10 feet deep,	11,761,200
Gardner Pond, 139 do. 20 do. do.	121,196,800
Westminster, 152 do. 20 do. do.	132,422,400
Whole 878 acres,	cubic feet 633,898,000

The loss by evaporation will generally be nearly compensated, by the rain, which falls upon these ponds. A loss of one foot by evaporation, from the surfaces of the six reservoirs, will be 38.245. 680 cubic feet; and supposing the whole loss from this cause, on the ponds, and canal, to be equal to 3 feet depth on the reservoirs, alone, the deduction from the foregoing amount, must be 114.737.040 feet, leaving a volume of water to be disposed of, through the navigation, of more than 519 millions cubic feet; subject, however, to the loss by filtration, absorption, &c. to which such works are more or less liable. From these views, and the foregoing remarks, there cannot be a doubt, that the supply of water, for the contemplated canal, over the Mud Pond level, will be abundant, at all seasons for the most extensive trade. Even the reservoirs alone, if it should be necessary to resort to them all, will be sufficient, without using the natural streams which are passed on the line.

COST OF THE WORK.

78. From a first trial level and survey, like that which has been made upon this line, an estimate of the expense, can only be considered an approximation. Careful and repeated levels should be ob-

tained ; the line of the canal, and position of aqueducts, bridges, culverts, &c. fixed, before any thing like minuteness, or accuracy, in a detailed calculation, is to be expected. The general face of the country, and the nature and extent of the principal obstacles are known, by this examination. But how to place a line of navigation, most advantageously for use, having a due regard to economy, in the execution, requires further, and more minute surveys and examinations. Enough has been done, perhaps, to shew the probable cost, under the heads of damages for land, &c.; of the canal ; of lockage ; aqueducts, and deep cuttings; reservoirs ; upon which, the following observations are submitted.

LAND AND WATER RIGHTS.

79. Little expense can be required for land. In general, the canal will be made over ground of small value, and in most cases, the importance of the work, and the immediate benefits resulting to the proprietors, would render an application for great damages unjust. There appeared to be an almost universal earnestness, throughout the survey to promote the work, and many owners expressed a readiness to give their land. Something must be allowed, however, on this account, and perhaps for water rights, also. But I am inclined to think, that by a judicious and skilful application and use of the means pointed out above, for constructing reservoirs, more than an equivalent to the loss, any mill owners or manufacturers can receive, or suppose they would receive from the construction of the canal, would be substituted. It is probable that for about 8 months of the year, the canal might be navigated, and that in ordinary years, for 5 months of this time, the streams would furnish

enough water for all hydraulic purposes, as well as for the canal, without drawing from the reservoirs; and that these resources would only be resorted to, for the remaining 3 months, during which time, the quantity shewn above, to remain after allowance for evaporation, equal to more than 519 millions, would fill the whole line of the canal, once a fortnight.

TRUNK OF THE CANAL.

80. From the description of the country, over which the navigation is contemplated, it is evident that the formation of the body of the canal, would probably a little exceed the ordinary cutting, for such undertakings, except the deep cuts, embankments, and works of art. On Miller's River, several circumstances before noted, occur, which will lead to extra expense, and in other parts of the line, the soil is rocky or filled with large stones. In the estimate, which follows, the probable amount of this branch of expenses, is put down. I call the canal 100 miles long, and include the spaces occupied by the locks, under the estimate per mile, although the locks would occupy $5\frac{1}{2}$ miles.

LOCKS.

81. The height and fall to be overcome by locks, is 1959 feet. In some points it will be advisable, perhaps, to vary the lifts. High or low lifts, would cause some variation in the price of lockage per foot, but as the common depth of locks, is 8 feet, the estimate is put down at a price per foot, for the whole. A combination of two or three locks on some of the lower parts of the line, where the supply of water is ample, may be found expedient; but in falling from the summit level, to new feeders, the locks should be single.

AQUEDUCTS AND DEEP CUTTINGS.

82. Four large aqueducts will be required at Pearl Hill Brook, at the Nashua, Elzebeth, and Concord Rivers, and two or three smaller ones on Miller's River. Perhaps the last may be avoided by substituting dams. The deep cuttings are at Wilder's Ridge, at Col. Adams' in Acton, at Hagar's Ridge, on the right bank of the Concord, and at Woods' Bar. The last is of minor importance compared with the three former; and sinking the summit level, by Mud Pond, will require a depth of excavation, depending upon the level, to which, upon future trials, it shall be found expedient to drop it. Upon all these items of cost, nothing but conjecture can be offered. They are all unlocated, and the heights, and depths, of the levels, are not ascertained with sufficient precision, to warrant an accurate calculation. The passage of a canal over all these points is feasible, and would not swell the expense beyond what is frequently to be found, on a canal, of the same length. A tunnel, at Wilders' and at Hagar's Ridges, may be found preferable to deep cuttings.

RESERVOIRS.

83. The facilities of feeding from the reservoirs, which have been named, and the cheapness of converting these ponds, to such a use, are uncommonly favourable. Perhaps no instance can be found, where a canal, with such an elevated summit level, can be furnished with such an abundant supply, from artificial means, at so little cost. It would not be necessary, in the outset, to open all these resources, at once, but to begin with a feeder, from Lower Naukeag, which, of course receives the Upper Naukeag, and then, take the others, successively, as they shall be wanted. This feeder, would,

probably, be from one to two miles long, and together with the expense of deepening the outlet, and raising only a dam, sufficiently high, to flow 4 or 5 feet above its present level, the whole cost of turning this great source, into the canal, would be very inconsiderable, compared with its importance.

ESTIMATE OF THE EXPENSE.

84. For lands, water rights, &c. -	$ 20,000
For lockage, 1959 ft. deep, *a* $800 pr. ft. lift,	1567,200
For trunk of the canal, including culverts, bridges, defence walls, &c. *a* $8,000 per mile,	800,000
For aqueducts, deep cuttings, &c. -	300,000
For reservoirs, - - - - -	20,000
For superintendence, contingencies, &c.	292,800
	$ 3,000,000

85. Having thus given an account of the survey, and examination of a route, made according to your instructions, for a canal, between Boston Harbour, and Connecticut River, I hope the foregoing observations with the plans, and profile, herewith presented, will be found sufficient to enable you to decide upon the feasibility of this grand work. That it is practicable, and that the means of supplying it with water, are ample, there can be no doubt. The cost, however, cannot be estimated with that accuracy, which is desirable; but I trust, the remarks, and details, I have given, will enable you to correct any faults that may be found, in my statement, and that you will discover the means of corrections, wherever the amount of expense is found erroneous.

86. Before this line is adopted, it will be advisable, *First*, to examine parts of this route, again, to

ascertain how to avoid some of the difficulties, and how to overcome others, which this survey, presents. Several gentlemen, of known experience, and judgment, have expressed a belief, from their intimate knowledge of the country, that Wilder's Ridge, and consequently the valley of Pearl Hill Brook, may both be avoided, by following the general course of the Nashua, from Fitchburg, and going to the south of Dr. Wilder's house, in Leominster, where no deep cutting would be required; then falling into the surveyed line, a little above Edgarton's factory, at Shirley village. If a survey on this route, should be found to justify such an opinion, two very expensive and difficult passages on this, will be avoided.

87. *Second.* To have the proposed route, eastward, from Westminster, through Princeton, Sterling, Berlin, &c. surveyed. The most convenient point for crossing the dividing ridge, will, in that case, be found on the Westminster level, which is 15.62 feet, higher than Mud Pond. But, owing to the great elevation of any practicable summit, in this part of the country, it should be known by actual levels, and surveys, whether this route can be extended across the Mud Pond level, instead of going over that, by Tophet Swamp, in Westminster.

88. *Third.* Although, the Bolton Ridge, presents a serious obstacle to the passage of a canal, on account of the expense, it may be found, upon a comparison of routes, that a tunnel, here, with some higher level, may render the route through Leominster, Lancaster, and Bolton, in some respects, more eligible, than any other. It will, therefore, be worth the expense, to cause this line, fifteen miles, of which, have been surveyed, to be continued westward, to Westminster, and brought down

to East Sudbury, across the Concord, to the point for passing over to Stony Brook, where the route, through Princeton, Sterling, &c. would meet it; thence, on a line common to both routes, over the high land, to Stony Brook, and so on to Boston.

89. *Fourth.* From Sandy Pond, in Groton, near the school-house No. 11, the water may be turned with great ease, to Spectacle Pond, into which falls Shaker's brook. The stream from Spectacle Pond passes through Forge Pond, in Westford, from which it is called Stony Brook, until it drops into the Merrimack River, in Chelmsford. From information derived from intelligent gentlemen, and from my own observation of part of this section of country, it will be quite easy to open a communication through the valleys of these ponds and brooks, to the Middlesex Canal, in Chelmsford. Whether it would be expedient to carry the main line of the proposed canal in that direction; or whether a branch only should be taken off from it that way, are questions which it may be important to have the means of settling. It will therefore add much to the valuable hydrographic information which these surveys will furnish, to cause a level and examination to be made, between the Nashua at Staples' mills, and the Middlesex canal.

90. The heights of the following points, as ascertained in the surveys and cross levels, for a canal from Boston to Connecticut River, are counted from low water mark in Boston Harbour. The level at low tide, is taken at 10 feet below the marsh, at the foot of the old dike, on the east side, near the Boston Cordage Manufactory.

		FEET.
91. Full basin of Boston and Roxbury Mill Corporation,		10.80
Surface of pond above the dam	Watertown,	14.48
Bemis' mill pond,	do.	20.44

		FEET.
Lower Factory Pond,	Waltham,	25.88
Upper do. do.	do.	37.50
Bench on great oak by P. T. Jackson's,	do.	60.34
Do. on elm, by school-house on plain,	do.	70.22
High ground in Hagar's field,	do.	136.41
Bench on ash, in meadow, by Hobbs',	Weston,	95.21
Do. on elm, by Fiske's store,	do.	120.38
Water of Stony Brook,	do.	118.52
Bench in cluster of maples,	do.	148.78
Do. on pine, in Biglow's, part of Abbot's swamp,	do.	181.53
Top of Hagar's ridge,	Lincoln,	193.02
Road by Farrar's,	do.	158.95
Concord River,	do.	114.47
Brown's swamp,	Sudbury,	183.94
Adam's swamp,	do.	206.89
High land by Col. Adams',	do.	216.48
Road by Dakin's,	do.	193.47
Meadow and brook, foot of Hayward's ridge,	do.	178.21
Fork of roads,	Acton,	207.03
Elzebeth River, above Sherman's mills,	do.	139.94
Fort pond brook, level with top of Faulkner's dam,	do.	195.27
Top of Woods' bar,	Littleton,	250.60
Long pond, in	do.	251.90
Warren's mill pond,	do.	215.79
Field by Sanderson's,	do.	234.46
Shaker's Brook, on line between Littleton and Groton,		220.28
Spectacle Pond, in Littleton and Groton,		212.54
Sandy Pond,	Groton,	226.90
Top of under-pinning of school-house, No. 11,	do.	237.64
Stone's saw-mill pond, on Sandy pond brook,	do.	223.89
Sandy pond and Bear hill brook,	do.	213.03
Stone at corner of Nutting's barn,	do.	224.95
Nashua River, above Staples' mills,	Shirley,	216.70
Longley's mill pond,	do.	263.40
Edgarton's do.	do.	276.61
Cattacoonemaug Pond,	Lunenburg,	289,07
Mashapaug do.	do.	356.83
Meadow by do.	do.	357.54
Top of Goodrich's Ridge,	do.	403.87
Do. Wilder's do.	Leominster,	468,23
Pearl hill brook,	Fitchburg,	364.06
Top of under-pinning of Fitchburg meeting house,		492.72
Jewett's Factory Pond,	Fitchburg,	468.38
Phillips' brook, at mouth,	do.	521.19

Farwell's mill pond,	Fitchburg,	638.83
Guide-post by Bacon's,	Westminster,	675.78
Brook's mill pond,	do.	731.72
Whitman's do.	do.	792.11
Gross' mill pond,	Ashburnham,	840.40
Glazier's lathe mill pond,	do.	855.50
Munroe's do.	do.	862.11
Burrill's do.	do.	876.87
Burgess' do.	do.	886.54
Adams' Brook,	do.	1064.89
Mud Pond summit level,	do.	1065.84
Upper Naukeag Pond,	do.	1129.19
Lower Naukeag Pond,	do.	1166.27
East Pond,	do.	1111.40
Wattatick Pond,	do.	1150.42
Gardner Pond,	Gardner,	1093.08
Westminster Pond,	Westminster,	1028.49
Richardson's mill pond, head of Adams' Brook,		1126.47
Ashburnham level, meadow by French's,	Ashburnham,	1099.95
Westminster level, east end Tophet swamp,	Westminster,	1081.46
Miller's River, at Cook's old dam,	Winchendon,	1017.62
Pierce's mill pond,	do.	998.70
Whitney's mill pond, at the village,	do.	950.27
Water of Morse's pond,	do.	937.04
Hyde's bridge, left bank of Miller's River,	do.	894.47
Brook to Dennis' Pond,	do.	830.02
Junction of Otter and Miller's Rivers,	do.	815.62
Water of Miller's River, by Furbush's,	do.	813·77
Top of Royalston Factory Dam,	Royalston,	811.29
River at Lewis' Bridge,	Athol,	690.74
Kendall's mill pond,	do.	571.58
Athol Factory Pond,	do.	539.66
River under Young's Bridge,	do.	500.69
Putnam's mill pond,	Orange,	500.19
River at Hosley's bridge,	Irvine s Grant,	485.41
Alexander's mill pond,	do.	451.46
River at Gunn's bridge,	do.	227.51
Top of Durkee's dam,	do.	191.74
Mouth of Miller's River, in the Connecticut,	do.	172.62
Col. Williams' Pond, on branch of Otter River,	Gardner,	1040.56
Merriam's mill pond,	do.	1006.60
Sawyer's mill pond, on Otter River,	Templeton	908.83
Stone's mill pond,	do.	891.00
Deadman's Factory Pond,	do.	880.22
Baldwin's mill pond,	do.	847.67

92. The above memorandum of heights is inserted, in the belief that it will be convenient to many, who have made examinations of the country, or who wish to pursue their enquiries, relative to the canal.

93. I have thus communicated to you, Gentlemen, the result of the surveys and levels, which have been made under your instructions, and I have endeavoured to place the subject before you, in as plain a view as possible, in hopes you will be aided by it, in the important duties assigned you. There will be noticed, doubtless, many omissions, of important particulars, which may be serviceable to you, but which, have escaped my observation, and if further facts, or more minute details are desired, I shall be happy to furnish them, when requested.

94. I ought not to close this letter, without making known to you, the numerous instances of kindness and valuable assistance, I have received, throughout the surveys, from the gentlemen who served on the committees, in almost all the towns through which I passed. For their attention and obliging civilities to me, I am personally, under the greatest obligations; and the labour of the surveys and examinations has been greatly facilitated and hastened, by their cheerful aid, and their correct information, upon the character of the country, over which it was desired to extend the levels.

I remain, gentlemen,
With great respect and esteem,
Your obedient servant,
LOAMMI BALDWIN, *Engineer.*

Boston, January 9, 1826.

RECONNOISANCES,

OF

CANAL ROUTES,

FROM

CONNECTICUT RIVER, TO THE HUDSON.

In conformity to the Resolutions, under which the Commissioners act, "*having found*, that *a ca-*"*nal could be constructed*," from Boston Harbour, to Connecticut River, they explored, one entire route, and a considerable portion of a second, "to "ascertain the practicability of extending the "same, to some point, on Hudson River, in the "State of New-York, in the vicinity of the Junc-"tion of the Erie Canal, with that river."

DEERFIELD AND HOOSACK RIVERS ROUTE.

One hundred rods below the mouth of Miller's River, the Montague Canal Company, have erected a dam across the Connecticut, 330 feet long, which flows that river nine feet, and is sufficient to cover the rapids, that extended a mile, above the mouth of Miller's River. On the left bank, of the river, is a lock, one hundred feet in length, and twenty feet wide, for the passage of boats and rafts.

Four miles below Miller's falls dam, are the Montague falls, or "Great Bar," where there is a dam 1000 feet long, and, including the whole fall, thirty-one feet, and a half high. The channel, being divided by two small islands, or elevated ledg-

es, they serve as piers, to connect, and support the dam, which is built of timber, and sets the water back to the foot of the other dam, by which means the rapids are overcome between the two dams, and boats are enabled to pass without interruption; it also supplies, with water, the canal, which has been constructed to avoid the Montague falls, and rapids. This canal is twenty feet wide, two feet and a half deep, and nearly three miles in length, and has been cut across a level piece of land, formed by the river, which here makes a great detour.

At the end of the dam, on the left bank, is a guard lock, where the boats, and rafts, are let in, and proceed down the canal, and through eight locks, to its debouche, into Connecticut River, a half a mile below the mouth of Deerfield River. The whole fall from Miller's River, is 71 feet.

These dams were erected, and the canal completed, in 1800, and save six miles of land carriage. The annual receipt of tolls, amounts to eleven thousand dollars.

The natural obstructions to navigation, from Miller's falls to Deerfield River, have not been surmounted, in the cheapest, or best manner. A mile, or more, below the mouth of Miller's River, are the "Narrows," where the Connecticut, is not exceeding one hundred yards wide, with high, and almost perpendicular ledges, on each bank, the bases of which, form the bed of the river. Here, a substantial dam can be erected, of massive blocks of stone, which is to be procured, in the immediate vicinity, either of primary, or secondary formation, as granite, abounds near the mouth of Miller's River, and red sand stone, slate, and conglomorates, constitute the banks of the Connecticut, for miles below the Narrows, and some distance above.

This dam being elevated as high as the level of the present upper dam, that is, about ten feet above the summer surface of the river, will render that, and the very long, high, and expensive one, at the Great Bar, unnecessary; for the canal can be commenced at the Narrows dam, and conducted a short distance down the left bank of the river, and then turned across the low, and level land, so as to debouche, nearly opposite the mouth of Deerfield River, to connect the Miller's river line, of canal, with that to the Hudson, which passes up the valley of Deerfield River.

A half mile, southwest of the confluence of Miller's River, with the Connecticut, is a partially detached eminence, one hundred feet high; and the whole hill, which is not less than one hundred rods in circumference, at its base, is traversed, by numerous veins of iron ore of various thickness. It is the specular oxide of iron. The principal vein appears at the top of the hill, and is nearly ten feet wide; laying in a north and south direction. The ore is abundant, and generally pure. Masses that have been blasted, weighing from one to two hundred pounds, lie upon the surface. The gangue is quartz, and the walls, and hills, granite. This vein has not been worked.

Beds of micaceous iron ore occur, and have been wrought in Bernardstown, on the right bank of Connecticut River; six or eight miles from the Great falls.

Green carbonate of copper, in green stone, constitutes a vein, on the banks of Connecticut River, in Greenfield, below the Great falls. It passes into the hill on one side, and under the river on the other. This copper mine has never been wrought; but may, on trial, be found productive.

In the town of Leverett, which joins Montague,

on the south, there is a vein of galena, or sulphurate of lead. The direction of the vein is nearly north and south, and extending twenty miles from Montague, to Hatfield. The gangue, is sulphate of barytes. A mile south of this vein is another of galena, copper pyrites, and blend, or the sulphurate of zinc. The gangue is sulphate, of barytes, and quartz. The galena and sulphurate of copper are disseminated, through it, in about equal proportions. The blend appears only occasionally. This vein is several feet wide, and has been wrought, in a few places, to a small extent.

There are extensive slate quarries in the towns of Vernon, and Guilford, in Vermont, about ten miles above Greenfield. One of them is only three miles from Connecticut River, but has not been extensively wrought, owing to the expense of transportation, to a great market, on the sea coast. The slates are of the first quality, and the quarries inexhaustible. During the war, many were sent to New-York, and Boston.

In Vernon, are extensive beds of granular quartz, which has been used for making glass.

Professor Hitchcock, of Amherst College, from whom these mineralogical details were chiefly derived, states in his communication, appended to this report, that he does not despair of discovering coal, along the Connecticut, and that he knows of no place more likely to contain it, than between the mouth of Miller's River, and the Great falls. So far as he can judge, from specimens, he thinks, all the rocks of the coal measures exist there.

A vein of quartz, several feet wide, occurs in Conway, six or eight miles from Deerfield River, containing the oxide of manganese.

Connecticut River, just below the mouth of the Deerfield, is about thirty rods wide; and the banks

are but seldom, if ever overflowed, being thirty, or forty feet, above the usual summer surface of the water.

It may not be necessary to resort to an aqueduct or dam to cross the river, as the boats can descend into it, from either bank, by locks, as is done from the United Erie and Champlain canals, opposite Troy, and easily pass over, by the aid of an iron rod, extending from bank to bank.

The canal line, up the valley of Deerfield River, passes along the right bank, to Cheapside bridge; thence it deflects to the south, over the meadows of Deerfield, and east of the academy in that town, to Stillwater, above Stebbins' Dam,—distance seven miles, and the fall 45 feet. A range of hills, chiefly constituted of green-stone, extends from the northern bounds of Greenfield to the south part of Deerfield, nearly parallel to Connecticut River. Where the Deerfield has broken through this ridge, just below Cheapside Bridge, its elevation on the right bank, is very much depressed: but, still, some extra cutting, for thirty rods, will probably be necessary, in laying the bed of a canal. The remainder of this section, is over the alluvial margins of Connecticut and Deerfield Rivers, offering favourable land for excavation.

From Stillwater to Salmon Falls, in Shelburn, the banks of the river are generally precipitous; but the southern one presenting a more gradual declivity, there will be no great difficulty in constructing a canal, except at one point, near Sluice Brook, where there is a perpendicular cliff; but which may possibly be avoided, or passed, by an embankment, supported by a wall of stone.

To cross South and Bear Rivers, either large culverts, or small aqueducts will be necessary.

The distance from the mouth of the river, to the

top of Salmon Falls, is nearly fifteen miles and an eighth, and the descent 297 feet. This is the only cataract, of any magnitude, upon the route, the fall being 47 feet, within the distance of forty rods, offering valuable hydraulic privileges, which are partially occupied by grist and saw mills, clothiers' works, and a manufactory of beech and maple shaving boxes, in which, between fifty and sixty thousand are annually made.

A mile and a half above Salmon Falls, North River enters the Deerfield, in the south-east corner of Buckland. Its sources are in Vermont. A mile above the mouth, in Coleraine, is a fall, where there are saw and grist mills, and a cotton factory. Near the centre of Coleraine, this river divides into the east and west branches, on which are situated numerous saw, grist and shingle mills, clothiers' works and other small factories.

One mile and a quarter above North River, Clessan's River enters the Deerfield, from the south, having its sources in Hawley and Ashfield. Near its mouth is a shaving-box manufactory, and above are several saw and grist mills. It is a copious perennial stream.

Above the mouth of North River, the flanks of the hills close on the bed of the Deerfield, and contract its channel for some rods, when the level banks again expand into the vale of Charlemont. The left bank presenting the most favourable ground, it will be expedient to run the canal across the river, just above the defile. From this point, for more than ten miles, to Hawks' meadow, near the mouth of Cold River, the left bank is generally a continued alluvial plain, in which not a single obstruction occurs, in the line of canal, and the fall is only about 140 feet.

Mill Brook, descending from Heath, enters the

river in Charlemont, about fifty rods east of Thayer's tavern. Near its mouth is a flour mill, with three run of stones—the best in that section of the State ; a large tannery and a saw mill.

Nearly a mile and a half east of the western bounds of Charlemont, Chickley River enters from the south, having its fountains in Hawley. In a mountain near the bank of the river, and three miles from the Deerfield, is an inexhaustible mine of magnetic and micaceous iron ore. It has been wrought for many years upon a small scale ; but last spring it was purchased by a gentleman in Greenfield, who intends establishing very extensive works. The canal being completed, and a railway constructed to it, from the iron forges, would immediately render this mine of vast consequence, as the ore is most prolific, and the iron produced, of the very first quality.

In Whittingham, Vermont, eight or ten miles north of the village of Charlemont, is a quarry of lime-stone, which is used as marble, and for making lime, of a good quality.

Cold River has its source in Hoosack mountain, and falls into the Deerfield, a fourth of a mile west of Charlemont. During the spring, it has considerable water, but soon diminishes to a mere rivulet.

It has been suggested, by gentlemen who have passed up the valley of this river, for the purpose of locating a new and more eligible road to Adams, that it was possible that a canal might be extended in this direction, over the mountain. To supply the lockage with water it was supposed that a capacious reservoir could be constructed, by throwing a high dam across the deep valley of the river, near the summit of the mountain, which would be filled by the vernal floods ; and from thence by a

tunnel two miles in length, the line could descend the western flank, to Hoosack River, in Adams. But there are powerful objections to this route ; as it is not probable that sufficient water could be obtained, to supply the vast consumption of such a lofty line of locks ; and if this could be effected, the difference of height of the bed of a tunnel above the surface of the Deerfield, here, and at the Great Bend, being probably six or eight hundred feet, will cost more for locks, than the extra two miles of tunnel, at the latter place ; for, to pass an elevation of 116 feet, which requires, ascending and descending, 232 feet of locks, the expense is equal to a mile of tunnel ; and a boat can pass the latter in a sixth part of the time, which would be consumed in going through the former.

One mile and a quarter above Cold River, Pelham Brook enters the Deerfield, from the north. It has its source in Rowe, and affords sufficient water for several mills.

From Cold River to the Great Bend, about $\frac{1}{4}$ of a mile above King's house, there are no serious obstructions to be encountered, except at Stone-Gate falls, where the mountains rise precipitously from the immediate bed of the river ; and for eight or ten rods it will be necessary to cut a shelf in the rock, on which to run the canal, or support it upon an embankment reveted with a stone wall ; and then run it over to the right bank, as the land is more favourable, on that side of the river for excavation.

The whole distance from the Great Bend to Connecticut River is $34\frac{1}{8}$ miles, and the fall $611\frac{35}{100}$ feet.

The height of Hoosack mountain, above the surface of Deerfield River, opposite King's house in the town of Florida, is 1448 feet, and $2060\frac{10}{100}$ higher than the Connecticut, at the confluence of those rivers.

To pass this stupendous mountain, two modes present themselves; the one by *locks*, and the other by piercing it with a *tunnel.*

From the Great Bend, the general course of Deerfield River is north. Having its sources in Vermont, the main branch descends through the eastern vallies of the Green Mountain range, to its confluence with the western branch, which, rising in the ponds of Woodford, passes through Stamford, to the eastern borders of Reedsborough; and from thence the united streams rush, with impetuosity, through a sinuous and precipitous channel, along the eastern flank of Hoosack mountain, while others of nearly as great altitude, constitute its left bank; and rising with steep and rocky acclivities, from the very shores, they present most formidable obstacles to the construction of a canal, which must be supported, in many places, on embankments, or laid on shelves, cut in the flanks of the mountains.

The long range of the Hoosack or Green Mountain, which extends like a mighty rampart, from Savoy to Reedsborough, and whose summit profile for the whole distance, is an unbroken horizontal line, suddenly sinks 578 feet, in the northern part of Stamford and Reedsborough, forming a broad gorge, through which the western branch of Deerfield River winds its course, passing within 100 rods of the northern branch of the Hoosack; which has its source in the north-west corner of Stamford, and running south, unites with the southern branch in the North Village of Adams. This elevated table land is filled with swamps, meadows and numerous ponds, whose outlets fall into the channel of Deerfield river.

In Woodford are the five following ponds, numbered on the map 1, 2, 3, 7 and 8.

No. 1. By a dam at its outlet twelve feet high and eight rods long, and a side dam four feet high and ten rods long, the surface of the pond may be extended to seventy-five acres.

No. 2. A dam ten feet high and twenty-five or thirty rods long, will increase the area of this pond to 150 acres.

No. 3. A dam ten feet high and six rods in length, will flow 50 acres.

No. 7. A small dam will extend the area to 75 acres.

No. 8. This is a long meadow, in which the stream, that passes through it, occasionally expands into small ponds, and may be converted into a reservoir of an hundred acres at a trifling expense.

In the town of Stamford are the following ponds, numbered 4, 5 and 6, on the map.

No. 4, or Mud Pond, may be converted into a reservoir, at the expense of a few hundred dollars.

No. 5. This is a small pond, but may be easily extended by a dam, to seventy-five acres.

No. 6, or Stamford Pond, may have its area extended to 250 acres, by erecting a dam, ten feet high and fifteen rods long.

By a cut, six or seven miles in length, through Searsburg, the water from the main branch of Deerfield River may be conducted into a stream, that falls into Pond No. 3.

The summit level, between the western branch of Deerfield river and the north branch of the Hoosack, is nearly one hundred feet above the former, but the ridge is not more than ninety rods wide, extending from the road, between Adams and the Brattleborough Turnpike, which runs through Reedsborough, in a south-eastern direction, to the base of the Green or Hoosack mountain, distant a third of a mile.

Although Deerfield West Branch is only one hundred rods north of the crown of the ridge, still it is necessary to tap that branch two or three hundred rods higher up, and conduct the water in a feeder, round on higher land, for nearly a mile and a half, to prevent the necessity of a very deep cut through the ridge, for the canal, which, in consequence, will not require one of more than 35 feet, and this for only fifty or sixty rods.

At the point where the feeder must be taken out of the West Branch, a dam should be erected, one hundred and fifty yards long, and, the banks being high, it can be done with fecility, which will form a capacious reservoir, into which the accumulated waters of all the ponds, and of the North Branch of Deerfield river, could be concentred; and it is presumed will be sufficient to supply the lockage and canal, down the valley of Deerfield River, and of the north branch of the Hoosack to Adams North Village; the latter being eleven miles from the summit level, and the Great Bend of the Deerfield River, nearly the same distance.

The basin of the Hoosack North Branch, is favourable for laying the bed of a canal, as from its alluvial margins the ground has a gentle acclivity, spreading out into a broad vale, to the base of the mountains, which recede on the right bank, as the river descends towards Adams.

The height of the summit level, in the gorge of of the Green Mountain, has been barometrically ascertained, by Professor Dewey, of Williams College, to be 870 feet above the surface of Hoosack River, in Adams North Village; but he supposes it may be less above the Deerfield, at the Great Bend.

From the Great Bend of the Deerfield to the Hoosack, in Adams, the distance is four miles, on a

level, run through the base of Hoosack Mountain, which will be the length of the required tunnel, including the headings.

Near the Great Bend is a deep ravine, which plunges into the flank of the mountain, nearly half a mile, the bottom of which, for some distance, is nearly as low as the surface of the river; and by commencing the heading at the eastern end of the tunnel, in this ravine, and driving it up to the depth of thirty-five feet, the length of the tunnel can be much shortened.

All the water, which it has been stated, may be accumulated, to supply a lockage, over the mountain, in Vermont, may be rendered tributary to the canal, at both ends of the tunnel, by turning it into the Deerfield and Hoosack Rivers, as natural feeders, in such proportions, as may be found necessary.

The objections to passing over the mountain, through the gorge of Stamford and Reedsborough, are powerful, and perhaps conclusive. It is possible that sufficient water can be collected from all the sources named and brought to the summit, to supply the lockage down both sides of the mountain; but granting that it should be ascertained, there was an ample quantity, which is very probable, the distance will be increased eighteen miles; and the eastern section of the canal must be expensive, exclusive of the locks, from the rugged features of Deerfield River valley.

The cost of these eighteen miles of extra canal, is estimated as follows:

Construction of Canal, - -	200,000
Two hundred and twenty locks at 8,000 dollars each, - - -	1,760,000
Dams for Reservoirs, - - -	50,000
Feeders, - - - - -	80,000
	$ 2,090,000

To pass this extra distance, which, exclusive of locks, is thirteen miles and a half, will require five hours, and to pass 220 locks, allowing only five minutes to each, will require eighteen hours and twenty minutes, making twenty-three hours, and twenty minutes, or two days, if the boats do not move during the night; but to pass through a tunnel, four miles in length, will require only one hour and twenty minutes, provided it is furnished with a towing path, which should be the case.

The cost of a tunnel it is difficult to ascertain with much exactness, although great exertions have been made to collect information on the subject. In Great Britain where many have been constructed, within the last fifty years, the expense has been various, owing to the nature of the soil, difference of their height, width, and manner of executing the work.

The tunnel at Blisworth, on the Grand Junction Canal, is 3080 yards in length. The internal width is $16\frac{1}{2}$ feet;—the depth below the water line is seven feet, and the sofit of the arch 11 feet above the same line. The side walls, of the lining, are the segments of a circle of 20 feet radius; the top and the inverted arch of the bottom are of 8 feet radius. The side and top walls are seventeen inches, or two bricks thick, and the bottom inverted arch thirteen inches, or a brick and a half thick. The soil through which this tunnel was pierced, was principally a hard clay, in which were included some rocks. It cost $69\frac{48}{100}$ dollars per running yard, or $122{,}284\frac{80}{100}$ dollars per mile.

The Faulridge tunnel, on the Leeds and Liverpool canal, was through loose and bad ground, and part of the work done in the year 1794, cost $106\frac{56}{100}$ dollars per mile.

D. S. Bates, Esq. calculates the expense of a

tunnel, which, as Engineer, he has projected, on the Ohio Canal, 80 rods in length, the excavation of which, averages 38 by 30 feet, exclusive of the headings, at 96,822 dollars.

Gen. S. Bernard, of the U. S. corps of Engineers, and one of the most able civil and military engineers of the age, who was written to for information, promptly answered the queries, which were submitted to him, and the following extract contains his estimate of the expense of constructing a tunnel of the largest size.

" The cost of a tunnel depends mainly upon the dimensions of the work, the nature of the ground, and the altitude of the ridge above the bottom of the tunnel; therefore, the expense required to construct a tunnel can hardly serve as a standard to ascertain the cost of another tunnel, whose circumstances are different. However, for a general and preparatory estimate, I would consider three dollars per cubic yard as a tolerable estimate through rocky ground; the excavation, shafts, lining of the inside of the tunnel, being included in that price."

" Example.—The area of the transverse section of the profile of the tunnel being 60 square yards, the running yard would cost 180 dollars, or 316,800 dollars per mile."

" In that valuation, the transverse section of the lining masonry is comprised, in the area of the profile of the tunnel. The mean altitude of the ridge above the bottom of the tunnel is supposed to be 200 feet."

Among a number of queries submitted to Gen. Stephen Van Ransellaer, President of the Board of Canal Commissioners of the State of New York, was the following : " Quere No. 8.—What was the expense per cubic yard, in excavating the " *deep*

cut" through the ledge, at the "mountain ridge"; the depth, width and length of the canal through that ridge?" Answer.—"The expense of excavating the rock at the Mountain Ridge, per cubic yard, has been one dollar and seventy-five cents; the depth of cutting has ranged from 18 to 31 feet; the width at the top and down to the towing path is 40 feet; the remainder is 30 feet. The length of rock cutting is about three miles."

The cost of excavation of a cut through rock, the transverse section of the profile being equal to that of the Blisworth tunnel, viz. about 45 yards, including the lining, would, at one dollar and seventy-five cents per cubic yard, amount to 138,600 dollars per mile; but if the area of the section is as large as that given by General Bernard, it would cost 184,800 dollars per mile.

From Gerard Ralston, Esq. of Philadelphia, to whom application was made for information, the following details were received, of the tunnels on the canals in Pennsylvania.

"There is a tunnel in the mountain, from which the Lehigh Coal Company obtain their coal, of the following dimensions and cost:

"Length 600 feet, of which 430 are completed; width 16 feet; height 12 feet, and cost 31 dollars per foot, running measure; wages 83 cents per day for each man,—this sum includes the cost of powder, tools, and all other charges."

"The excavation is through exceedingly hard blue granite. Double hands are constantly employed; ten men at night, and ten during the day; which number is the greatest than can be conveniently employed, as it requires four feet width of space for every set of two men."

"The above information I obtained from Mr. Gillingham, Vice President of the company, who

returned a few days since from the works, and therefore it may be relied on. This is probably the most expensive tunnel on record. The average of tunnelling in England is, I think, a guinea per foot. No walls or arches are required, the rock being sufficient to support the superincumbent weight."

"The tunnel on the Schuylkill canal cost as follows. The information was obtained from Mr. Cadwalladar Evans, the late President of the company, under whose direction the work was completed.

"Length, a little upwards of 400 feet; width 18 feet; height 10 feet; cost, by contract, 40 dollars per yard, running measure. The contractor made a good living profit. The workmen were employed day and night for eight months, and worked at each end. The progress each twenty four hours was various, and it is not known exactly. The hill through which the tunnel passes is a sound slate rock, through which it was necessary to blast the whole distance. No walls or arches required. The contractor is an Englishman, accustomed to this kind of work."

"I have received from Mr. S. Mifflin, the President of the Union Canal Company, the following information:

"Length of tunnel 286 yards; width at the base 18 feet; height 12 feet; so as to contain not less than 24 cubic yards in every running yard; cost per running yard 50 dollars, if arching should not be required; if it should, in consequence of the badness of the materials, the Engineer is to estimate the price of excavation, and the contractor is to arch at two dollars per perch, with good hammered stone and common lime mortar. If cement should be used, it is to be found by the company.

The deep cutting to where the depth does not exceed eight feet, costs 50 cents for slate-stone excavation, and 12 cents per cubic yard for earth excavation."

" The nature of the hill through which the tunnel passes, is principally of black slate, pitching to the south, at an angle with the horizon of about 80 degrees. Some lime-stone and masses of sulphate of iron are found in it."

From these statements it appears that the several tunnels named, cost per cubic yard, as follows :

Blisworth, about - - - -	1.54½
Ohio, nearly - - - - -	1.73⅔
Schuylkill, - - - -	2.00
Union, - - - - - -	2.08⅓
General Bernard's estimate, - -	3.00
Lehigh, nearly - - - -	4.36

As it is highly important there should be sufficient width to admit of a towing path, and afford a free passage for the boats, it is proposed to make the tunnel through the Hoosack Mountain twenty feet wide, and thirteen and a half feet high ; the transverse section of the profile of which is thirty yards ; being larger, in the clear, than either of those in Pennsylvania or Great Britain. Taking it for granted that the excavation will be entirely through rock, but of a character which will make the expense a mean of the three in Pennsylvania, that sum might be taken as the cost. But to put it beyond a doubt, the highest price which any tunnel has cost per cubic yard, will be assumed, viz. that of the Lehigh. In a tunnel, four miles in length, of the size named, there will be 211.200 cubic yards of stone to excavate, which, at $4\frac{36}{000}$ dollars per cubic yard, amounts to 920,832 dollars.

Thus it appears that the construction of a tunnel will be 1,169,168 dollars less, than the expense crossing the mountain in Vermont, by locks.

There is no hesitation therefore in deciding in favour of a tunnel ; but even if its expense should exceed the other mode of passing the mountain, a tunnel is preferable, for the reasons which have been assigned. And this formidable barrier once overcome, the remainder of the route, from the Connecticut to the Hudson, presents no unusual difficulties in the construction of a Canal, but in fact the reverse, being remarkably feasible.

The geological constitution of Hoosack Mountain is primitive, and the rocks are chiefly mica slate, granite, gneiss, hornblend, granular quartz, in boulders, or broken fragments, from the smallest particles to masses of many tons ; but at its western base, in Adams, granular lime-stone or marble, of a brilliant whiteness, abounds, resting on mica slate, and connected with large blocks of granite.

As mica slate and hornblend, of a loose and shelly texture, prevail, and the whole of the rocky conformation being broken into numerous fissures, the excavation of a tunnel will not be more difficult than the cut through the " Mountain Ridge," on the Erie Canal, where the rock, consisting of a mixture of flint and lime-stone, disposed in irregular layers, dipping in different directions, was hard to drill, and after being drilled and charged, often but little effect was produced by the explosion.

The Southern Branch of Hoosack River, rising in Lanesborough, descends through the deep valley, formed by Hoosack and Saddle mountains, and unites with the North Branch, in the North Village of Adams. In this village and town are six cotton and two woollen manufactories, a furnace, trip-hammer, and clothiers' works ; and there are several grist and saw mills, situated along both branches, nearly to their sources.

Lime and marble of superior quality, may be sent from Adams, to any extent, and would afford great traffic for a canal. Iron ore is also found in the vicinity.

From the confluence of the North and South Branches, the course of Hoosack River is north-westerly, and sweeping round Oak Hill, passes through Williamstown, where meeting the Taconcik range of mountains, along the summit of which the boundary line between Massachusetts and New York runs, it bends to the north, through the southwest corner of Vermont.

Green River, which has its chief sources in Hancock and New Ashford, falls into the Hoosack a mile north-east of Williams College ; and West Brook, which rises in the flank of the Taconcik mountain range, enters the river a mile and a half south of the bounds of Vermont.

On one or both banks of the Hoosack, is a fertile interval, of varying width, rarely extending to half a mile. Its channel is five or six rods in width, and the current rapid ; but there is no sudden fall until it reaches that in Pownal, on which are situated Brown's mills, within half a mile of the boundary line, between Vermont and New York.

Soon after the river enters the State of New York, having escaped through the Alpine regions of Massachusetts and Vermont, the hills gradually recede, with rapidly depressed altitudes, from its shores, and passing through Petersburg and Hoosack townships, in a north-western direction, it suddenly turns to the west, in Cambridge, and winds its course through a wide and fertile vale, to Hudson's River, which it enters between the towns of Schatecoke and Easton, a mile below Still Water.

The broad and extensive basin of Hoosack

River, embraces one of the most productive tracts of land in the State of New York; wide intervals border the river, nearly to its mouth, and the soil of the hills, which gradually rise in undulating acclivities, but not to a great elevation, is a mixture of sand, calcareous detritus, gravel and clay, with substrata of slate, lime-stone and clay.

Little Hoosack River has its source in Stephenstown, and running north through Petersburg, enters the main channel, two miles and a half above the village of Hoosack Four Corners, which is twenty-four miles east of Troy, and about the same distance from the mouth of the river.

Half a mile north of the Four Corners, on the right bank of the river, several slate quarries have been opened, and more than twenty others might be wrought, within an area of 300 acres. The slates are of the finest quality, and from four to seven hundred squares are annually made; each square containing a sufficient number to cover one hundred yards square of roof; but the land transportation to Troy is so great, that it has prevented the quarries from being very extensively wrought.

Three miles below the Four Corners is the "Great Falls" Village, where are saw and grist mills, clothiers' works, a manufactory of cloth-shearing machines, a machine for dressing flax, and a cotton factory. The whole fall at this place is fifteeen feet.

The Walloomsack, which rises in Vermont, enters Hoosack River, a mile and three quarters below the Great Falls. It is a considerable stream, and a quarter of a mile above its mouth commences a series of falls or rapids, which extend 300 yards, with a descent of 40 feet, affording excellent hydraulic privileges, which have been partially occupied by the erection of several grist and saw mills, and a cotton factory.

Below the Walloomsack, the Owlkill and other streams enter the river from the north-east, and the Fiashoke and Tamkenick Creeks from the south; the latter is a large stream, and falls into the river two miles above its mouth.

The route for a canal is generally on the right bank, from Adams, and there is not any obstacle of great moment, in the whole distance to the Hudson; the descent being gradual, except at the Pownal and Great Falls, and the soil of easy excavation, save perhaps a short distance in Pownal, and possibly in the northern part of Williamstown, where the mountain ledges approach quite to the margin on the right bank of the river; but no great expense will be incurred by extending the bed of the canal along the declivity, on an embankment, or turning the course of the river, through the alluvial bottom land, on the opposite side.

Two routes are presented from the falls in Pownal. The first is down the valley of the river to near the Hudson, and thence deflecting to the north, crosses that river to the Lake Champlain Canal, at Still Water, where the current of the Hudson is tranquil, and the channel narrow; while a mile below, opposite the embouchure of the Hoosack, it is very rapid and the western bank high and rocky.

The distance from the point of intersection with the Champlain Canal, to its union with that from Lake Erie, is sixteen or seventeen miles.

The other line of Canal is on the left bank of the Hoosack, from the falls in Pownal, to a point south of the Four Corners; and from thence, leaving the river, is continued direct to the city of Troy. The distance to the junction of the Erie Canal with the Hudson, is not so great, on this route, by nearly seventeen miles.

South and south-west of the Four Corners, on the left bank of the Hoosack, a range of hills, commencing near the Little Hoosack, which separates it from the Taconcick Mountains, extend in a south-western direction towards Hudson River. On the north-western flank of this ridge, are 15 or more ponds, whose united outlets form the Poestenkill, a very considerable stream, which runs with a rapid current, over a slate-stone bed, to the Hudson, which it enters in the southern part of Troy.

From the above named south western range of hills, another branches off and sweeps round to the west, receding from the Hoosack, as it approaches the Hudson, and gradually sinks down into the undulating tract of country, which borders that river on the eastern side. At the base of this ridge, between two and three miles west of the Four Corners, Sanchaeseck Creek has its source, and running west, six or seven miles, enters Tamhenick Creek.

Southeast of Troy, between the Poestenkill and the confluence of the Sanchaeseck and Tamhenick Creeks, and northwest of the south branch of the Poestenkill, is a large tract of meadow called the "Drowned Lands," from its having been, formerly, a swamp of evergreens; but by clearing and draining it has been reclaimed, and extends nearly level, from northeast to southwest, for six or seven miles, and is from a quarter to a mile in width.

To cross the ridge, west of the Four Corners, and prolong the line of canal to Troy, it will be necessary to tap the Hoosack, at Brown's mills, in Pownal, and set off the Canal, along the flank of the high land, which rises from the alluvial deposition, on the left bank of the river, so as to keep up such a level, as shall be forty feet above its surface, when it reaches the ridge; to effect which,

the line must gradually recede from the river, soon after crossing the Little Hoosack.

As the Drowned Lands are 40 or 50 feet higher than the level, which can be brought from Brown's mills, in Pownal, a second summit must be assumed, at the southwestern end of the Drowned Lands, and the canal from thence to Troy, and to the eastern side of the ridge, where the line from Brown's mills ends, must be supplied by the Poestenkill, and the numerous ponds, which are the fountains of that stream, whose areas can be considerably extended, by the erection of dams at their outlets, which, it is presumed, will insure a sufficient quantity of water.

From Clow's mills, on the Poestenkill, near the southwestern end of the Drowned Lands, and four miles and a half from Troy, a level may be continued for fourteen miles, to Eldrid's tavern, and, perhaps, some distance beyond, where the ridge is to be passed, at its lowest point, in a gorge, called "Shingle Hollow," to meet the canal line, from Pownal, on the eastern side, near Shulter's house.

The highest part of the ridge, in Shingle Hollow, is estimated at seventy-five feet, above the level of the canal, on the west, and gradually descends to both lines, which are separated by it, about a mile; and to unite them, will require a very deep cut or a tunnel; but as the headings can be driven up to thirty-five feet in depth, the latter may be reduced to three quarters of a mile.

From Clow's mills the Poestenkill has a very rapid current, to the Hudson, as the descent is 350 feet.

Except the deep cut or tunnel, at Shingle Hollow, the route from Pownal to Troy is very favourable for laying the bed of a canal.

The difference of the expense between this ca-

nal line, and that down the right bank of the Hoosack, may not be deemed conclusive, in favour of the latter, when the difference of distance, which is seventeen miles less, on the former, to the junction of the Erie and Champlain canals, and the greater interest it will probably secure, by making the debouche at the City of Troy, are taken into consideration.

WESTFIELD AND HOOSACK RIVERS ROUTE.

The only possible routes from Springfield to the Hudson, "in the vicinity of the junction of the Erie Canal with that river, are up the vallies of the Middle and North Branches of Westfield River, to the South Branch of the Hoosack, and down its basin to Adams North Village ; and from thence, on one of the lines, that have been described, to Still-Water, or the City of Troy.

Westfield River has three branches ; the middle one rising in Peru, descends in a southeastern direction, between Worthington and Middlefield, through Chester, and unites with the western, in the northeast corner of Blandford.

The western branch has its source in Worthington, and dividing Becket and Middlefield, traverses Chester, nearly parallel to the middle branch.

The North Branch rises in Savoy and Windsor, and passing through Chesterfield, and Norwich, joins the Middle Branch a mile above its confluence with the West Branch.

All these branches run in deep vallies, over rocky beds and numerous cataracts, to their confluence, when the lofty hills rapidly recede from the main river, and the alluvial depositions, on its margin gradually expand into broad fertile meadows, particularly in Westfield ; and from thence intersect-

ing the great valley of the Connecticut, the channel traverses undulating plains of diluvial formation, to the rich intervals of that majestic river, which it enters opposite the southern bounds of Springfield.

The summit level, on the route up the North Branch, is in Savoy : and the water to supply the lockage must be, chiefly, derived from a large swamp in Windsor, and a few small streams, which, from the best information which the Commissioners could obtain, not having explored that projected line of canal, do not afford a sufficient quantity ; it is, therefore, extremely doubtful, whether a canal is *practicable* in that direction.

The summit level of the route, up the valley of the Middle Branch, is in Pittsfield, where the head waters of Housatonick River, and several ponds must be depended upon to supply the canal to Middlefield, or Chester, on the southeastern section of the line, and to Cheshire or Adams, on the northern section. It is possible sufficient reservoirs could be formed for this purpose ; but this cannot be decided without the data, which actual surveys alone can furnish ; but the altitude of the summit level, which must be nearly or quite as great, as that in Vermont, which was examined, on the northern line, and the rugged features of the country, the whole distance from Blandford to the borders of Pittsfield, being a succession of rocky hills and interminable ledges, impose most formidable and forbidding obstacles to the construction of a canal ; while the distance from the Connecticut to Adams North Village, following the line over which the level of a canal must be bent, will be at least 66 miles, when the route examined, through the valley of Deerfield River, is only 38 miles, making a difference in favour of the latter of 28 miles.

The objections to the route up the Middle Branch of Westfield River, apply with equal force against that up the North Branch, provided it should be ascertained that a sufficient quantity of water could be brought on to its summit level, to meet the consumption of a canal. There was, therefore, no hesitation in deciding in favour of the Deerfield and Hoosack Rivers route.

After the Commissioners had completed all the reconnoisances, except of the two most northern lines, to the Ashburnham summit level, being satisfied that there would not be either time or funds, sufficient to have accurate surveys made of the route from Connecticut River to the Hudson; and considering it of the highest importance, that they should be enabled to present an approximated estimate of the cost of constructing a canal in that direction, but which could not be done until the height of Hoosack Mountain and the descent of Deerfield and Hoosack Rivers, were ascertained, General E. Hoyt was employed to accomplish those objects, by running a trial level from the summit of the mountain, down the valley of Deerfield River to the Connecticut; which duty he performed in a highly creditable and satisfactory manner, and illustrated his report, hereto annexed, with a plan of the line surveyed;—and George Tibbits, Esq. of Troy, having generously transmitted a map, of the Hoosack region, which he had caused to be compiled from actual surveys, the Commissioners are enabled to present a tolerably correct one, prepared by George Baldwin, Esq. Asssistant Engineer, from the above and other materials, of the country, from the mouth of Miller's River to the Hudson, with a delineation of the whole, and a profile of the eastern section of the line of canal.

REPORT

OF

GEN. EPAPHRAS HOYT.

The following results of my surveys and levels, in the valley of Deerfield River, are respectfully submitted to the Commissioners of Canals in Massachusetts.

N. B. The distances are in chains and links, and the descent in feet and hundredths.

Beginning in King's Meadow, at the surface of the water of Deerfield River, at the foot of Hoosack Mountain,

	Distance.	Descent.	Total.
Thence to station staff, No. 20, near the toll-gate, above the turnpike bridge, -	251.37	67.06	67.06
Thence to No. 39, opposite to Hawk's tavern, below the mouth of Cold Brook,	201.47	56.15	123.21
Thence to No. 64, below Charlemont meeting house,	397.78	72.16	195.37
Thence to No. 99, a proposed place for a bridge, at Town-plain, on the rocks,	416.37	67.90	263.27
Thence to the head of Shelburne Falls, - -	95.30	51.07	314.34
Thence to Still-water, above Stebbin's dam, in Deerfield Meadow, - -	649.50	252.0	566.34
Thence to the mouth of Deerfield River, according to Mr.			

Hutchinson's levels——distance estimated -	400.	45.0	611.34
Total distance 30 miles	11.79.	24	11.79
Chains - - - - -			

On arriving at Hoosack mountain, we found it necessary to ascend to Rice's tavern for quarters, and as we proceeded up I took minutes for ascertaining the height, and in the morning continued them to the summit beyond Rice's.

The hypothenuse and angle at the base, of 22 triangles were carefully taken with the chain and vertical arch of my instrument, and the perpendiculars determined, trigonometrically; from which it appears that the summit of the mountain above King's meadow, is Feet 1429.77

To which add the elevation of the meadow above the water of Deerfield river, 18.99

Summit above the river, 1448.76

Descent thence to the mouth of Deerfield river, 611.34

Gives the height of the mountain above the mouth of Deerfield river. 2060.10

By adding Mr. Hutchinson's descent from the mouth of Deerfield river to Hartford, the elevation of the summit of Hoosack mountain above *Tide-water* will be obtained. I regret that I have not that descent.

My surveys and levels were taken by a Theodolite, with a good spirit level, telescope and vertical arch,—made by Jones of London, and imported by Dr. Prince of Salem for our Academy. Previous to the operations the level was adjusted by reversion in the Y's and at a pond of water, and the line of collimation carefully examined;—the nonius divides to 3 minutes;—the distances were measured

by a four rods chain,—the station staff 12 feet, divided to hundredths of a foot;—only one used. In declining the levels no allowance was made for curvature; and in general, the stations were so short that this was unnecessary. My confidence in the accuracy of the work would be greater, had more time been allowed for the operations.

If deemed important, a map of the river and adjacent hills and mountains, with a profile of the levels may hereafter be made for the Commissioners; though the latter, from the regularity of the bed of the river, would present little more than a rectangular triangle, whose base would be the horizontal distance, and the perpendicular the elevation.

Excepting in Deerfield meadow and through part of Charlemont, Deerfield River, generally follows a deep ravine, and the descent is pretty regular.

The only cataract of any magnitude, is *Shelburne falls*, where the descent is 47 feet, in about 40 rods. Along the upper part of the survey, the river is skirted by high mountains and small intervening vallies,—the latter generally under cultivation.

On viewing a considerable extent of the river, we often see a lofty mountain, which seems to present an impenetrable barrier, to further progress; but on approaching the point of view, we find the river, has a sudden flexure, gliding gently through a deep ravine, on a tolerably smooth bottom of water-worn stones and pebbles. In all parts of the river, the predominant rocks, *in place*, are mica slate; but some imperfect lime-stone is observable. In general the banks of the river, through which the river has its course, are composed of earth and rocks, by no means difficult to excavate;—and were it not for the lofty Hoosack, a canal might be constructed,

to unite the Connecticut and Hudson, at the ordinary expense. A tunnel four or five miles, through the mountain, composed of primitive rocks, would be a Herculean task,—probably too great for the contemplated object. Whether water may be found on the summit of the mountain, sufficient for a canal, is a question I cannot decide. *Cold River* is the only stream of consequence I have noticed in this quarter. This heads on the mountain, and passing southerly along a valley 150 or 200 feet below the summit, I have measured, winds its course easterly and northerly and falls into Deerfield river, near Hawk's tavern, about $5\frac{1}{2}$ miles below King's meadow ;—and the descent is said to be gradual. A new road over the mountain, is contemplated on this route.

I regret that I am not able to insert the ascent of Deerfield River, from King's meadow up the northwest branch, through the *Notch*, so called by the Berkshire people, who say this is a practicable route for a canal. But I believe Deerfield River must have a very considerable descent from the *Notch* to King's meadow ;—and the mountains in many places, are abrupt and elevated.

As a curiosity, I cannot omit to mention, that in the bed of Deerfield River, a little above Town plain, I found a *rocking stone*. I had placed my instrument upon it for an observation, and the wind, which was pretty brisk, instantly rolled the rock back and forth.

On completing my observation, I applied my hand and found I could move it with ease. The rock is globular, six or seven feet in diameter.

With respect, I am,
gentlemen, yours.
EPAPHRAS HOYT.

Deerfield, Sept. 20, 1825.

EXPLANATORY REMARKS
OF
GENERAL EPAPHRAS HOYT,
ON HIS MAP OF DEERFIELD RIVER.

The map has been delineated, principally, from surveys made the latter part of last summer, and exhibits parts of Connecticut and Deerfield Rivers.

The northern extremity of my level terminates on the top of the upper dam, near the point, where Col. Baldwin closed his survey of Miller's River; and here the level may be three or four feet above his closing point.

The part of the Connecticut included in the map, has been delineated from several old surveys, and plans in my possession, corrected by a few recent observations; the canal is sketched by the eye, and, probably, neither is strictly accurate; but it is believed, that they are not very erroneously laid down. The levels on this river, have been ascertained by taking the lift of the locks on the canal, as given by Mr. William Russell, the toll-gatherer.

The levels on Deerfield River, from its mouth to its entrance into Deerfield meadow, are deduced from minutes obtained from Mr. Hutchinson's, taken last summer, for a number of gentlemen in Hartford, and I believe may be relied on as correct. From this point the levels on the river to the summit of Hoosack mountain were taken by myself. The results have already been communicated, but as I have reversed them on the map, and added others, a new arrangement may be necessary, which is as follows. The elevations are in feet and hundredths, the distances in chains and links.

TABLE.

	Elevation.	Total Elevation.	Distance.
Commencing at the mouth of Deerfield River, thence to the head of Still-Water, where it enters Deerfield meadow, above Stebbins' dam,	45.00	45.00	560.00
Thence to Bardwell's Ferry,	26.55	71.25	205.00
" to the foot of Shelburne falls,	178.75	250.00	434.50
" to the head of the falls,	47.00	297.00	10.00
" to station 99, at Town Plain,	51.07	348.07	95.30
" to station 64, near Charlemont, Meeting house,	67.90	415.97	416.37
Thence to station 39, opposite Hancock's Tavern, near mouth of Cold River,	72.16	488.13	397.78
Thence to station 20, above the Turnpike bridge	56.15	544.28	201.47
Thence to station 1, head of King's meadow,	67.07	611.35	201.47
Thence to summit of Hoosack mountain,	1448.76	2060.11	175.50

Total distance 34 miles 27.29 chains.

Several other stations are given on the map.

As the distances of the stations were comparatively short, no allowance is made for curvature, in deducing the levels.

The elevations above the water, at the mouth of Deerfield River, are given by a line, drawn on the margin of the map of that river; which method I have adopted as a substitute for a profile, as the most simple. By running the eye along this line until it meets a dotted one, the height of the point, on the river, intersected by the latter line will be found in feet and hundredths. The same method is adopted for the elevations on the Connecticut, making, in both cases, the surface of the water of that river, at the mouth of Deerfield River the plane of comparison. The distance may be found by the scale of the map.

ESTIMATE

OF THE EXPENSE OF CONSTRUCTING A CANAL

FROM THE

CONNECTICUT TO THE HUDSON.

It is impossible to make an accurate calculation of the expense of constructing a canal, from Connecticut River to the Hudson, until complete surveys have been made, of the whole line; the streams and ponds measured and gauged; the reservoirs ascertained; the capacity and sites of the locks fixed; the size and number of the embankments, deep cuts, culverts, tunnels, aqueducts, dams, feeders and bridges determined; and numerous other details furnished, which can only be obtained, after the exact admeasurements, levels, and minute researches of the Engineer, have been made, in setting off the definite bed of a canal; but an approximated estimate is submitted, founded on such data as could be procured, during the preliminary operations, incident to the projection of works of this nature.

Length of canal, 78 miles, at $10,000 per mile,	$780,000
Hoosack Mountain tunnel, four miles in length, at $230,208 per mile,	920,832
Lockage east of Hoosack Mountain, $611\frac{34}{100}$ feet at $1000 per foot,	611,340
Lockage west of Hoosack Mountain, 711 feet, at $1000 per foot,	$711,000
	$3,023,172

GENERAL REMARKS

ON THE

IMPORTANCE, FEASIBILITY AND MEANS

OF

CONSTRUCTING THE CANALS.

The physical geography of Massachusetts, is conspicuously diversified, by that ruggedness of surface, peculiar to all countries of primitive constitution. Lofty hills, alternating with deep vallies; huge masses of stone, which some mighty torrent may have rolled from their natural location, are left poised on the bleak summits of isolated ledges, or partially buried in the diluvial debris of distant mountains; numerous ponds and elevated morasses; perennial springs, precipitous streams, and rivers of various magnitude, from the majestic Connecticut and Merrimack, to the more humble Concord and Charles, but all sinuous in their course; now rushing in cataracts, over rocky beds, then gliding smoothly, through long and narrow margins of level and fertile meadows, are the bold and striking features, which characterize, not only this State, but all those, comprising that section of the Union called New England.

The White Mountain range, extending in a southern direction, through New Hampshire, runs east of, and parallel to, Connecticut River; its summit line being from twenty to forty miles distant therefrom. Its apex, in Massachusetts, is Wachusett Mountain, in whose prolonged base,

Nashua, Miller's, Ware and Chickapee Rivers, have their sources. On the Atlantic side, the country slopes in abrupt undulations, to the north-east, and is traversed, longitudinally, by smaller ranges of hills; one branching off, from the heights of Rutland and Paxton, reaches the northern part of Harvard, and forms the right bank of the valley of the Nashua; and a second, sweeping round the western side of the great basin, in which Boston is situated, extends north, separating Charles from Concord River, and compels the latter, like the Nashua, to pursue its course to the Merrimack.

The stupendous Green Mountain range, stretching from the frontiers of Canada, to Long Island Sound, forms the right bank of the great valley of Connecticut River, and the left of that of the Hudson. Down its broad, extending flanks, Deerfield and Hoosack Rivers, wind their courses, in coincidence with a canal line from Montague to Troy.

From the topographical details which have been enumerated, in the account of the reconnoisances and surveys, this general description, and an inspection of the map of the State, it will be perceived, that all the extensive ridges of highlands and the chief streams, east of the White Mountain range, run at right angles to the whole route of a canal from Boston Harbour to Hudson's River, consequently opposing obstructions to its construction, which are seldom if ever encountered, in regions of secondary, or alluvial formation; which, more often, are expanded into plains, or gently undulating stepps, succeeding each other by abrupt, but generally small declivities; with occasionally conical hills, of no great altitude, sprinkled over their wide spreading surfaces; and the rocks are commonly disposed in horizontal strata, and covered with a deep vegetable loam, intermingled with calcareous detritus, constituting a fertile and exhaustless soil.

But the rugged character of the physical geography of Massachusetts, has induced an industry, which has formed a race of men, with constitutions as firm, and spirits as unyielding as her granitic hills. Great efforts were demanded to subdue the asperities of the soil; an untiring perseverance, and unremitting labours. What agriculture, the forest and mechanical skill could not furnish, to administer to their wants, or increase their wealth, was sought upon the ocean. Thus the fisheries were established; and the fleets of commerce traversed every sea, and returned freighted with the products of every clime. The glorious fruition of such honorable toils, and adventurous expeditions, are realized, in the prosperous career of the State. Her sons have been distinguished among those bold and hardy pioneers, who advanced into the western wilderness, at the close of the war for national independence; and the flourishing states of Ohio, Indiana, and Illinois, the Michigan Territory, and all that fertile section of New York, from the longitude of Utica, to the straits of Niagara, are the triumphant results of their perilous enterprize. Two thirds of the great western canal of the latter state, and the whole of that of the first named, extending from the mouth of the Scioto to Lake Erie, traverse those now thickly-populated regions, which have been reclaimed by their labours, and defended by their valour. Shall it then be said, that their sires, and those who have been reared, and dwell in the land of their nativity, have degenerated; that Massachusetts has lost her pristine energy, and is doomed to witness the grand progress of internal improvement, in more youthful states, and linger in the rear of this eventful age; when the march of the human race, to its most exalted destinies, has acquired an impe-

tus unprecedented in the annals of the world? The whole people will indignantly answer No.—They will merit and maintain the reputation which their ancestors acquired; firmly meet the moral and physical demands of the times, and urge forward those public works, which are required to extend and increase the facilities of intercourse with every section of the union. They will neither be appalled by the difficulties, which must be encountered, nor the expense which will necessarily be incurred. What their wants demand, they have the spirit and ability to achieve; for to free and enlightened citizens, nothing is impossible, which the public good requires should be accomplished.

If less favourable routes are presented, for constructing a canal, from Boston to Hudson's River, than were, fortunately, found for those of Erie and Champlain, it is not to be inferred, that the project should be abandoned; far greater impediments have been surmounted, than any which must be encountered on that line. To modern engineers there is nothing novel; no work to be performed which they are not in the constant habit of successfully executing. Tunnels, aqueducts, locks and embankments, are the great means, which their scientifical ingenuity and practical experience have furnished, for conducting canals over the roughest countries, and some of them, were either unknown, or not resorted to, for like purposes, by the ancients; but which have been extensively applied in Europe, within the last half century, and are rapidly becoming familiar in our own country.

In the Delta of Egypt and the plains of Babylon are to be traced the vestiges of the first canals which were constructed. Primarily they were merely small channels cut for the purposes of ag-

ricultural irrigation ;—conducting the waters of the Nile, Euphrates and Tigris through the fertile fields of those once flourishing empires. But ultimately they were extended in length, width and depth, and became subservient to navigation ; still, from the topographical features of those countries, neither locks, aqueducts nor tunnels were required, as they were generally straight excavations, of one level, through which the water uninterruptedly flowed. In Venice and Holland similar canals were early made, and it was not until towards the close of the fifteenth century, that locks were invented, by the brothers Dominico, the celebrated civil engineers of Stra, near Viterbo, in Italy.

The first canal, furnished with locks, completed out of Italy, was that of Briare in France, between the Loire and Seine, during the reign of Lewis XIII: but the first canal in which locks, aqueducts, tunnels, artificial reservoirs, deep cuts, embankments, and, in fact, all the modern improvements were introduced, was that of Languedoc, commenced in 1667 and finished in 1681. Here all the talents and resources of the Engineer were laid under requisition, and his art exhausted ; for rivers, vallies, and mountains were to be passed, and water conducted from a great distance to supply the canal. Many other expensive canals, have since been constructed in France.

Eighty years after Riquet had commenced the Languedoc canal, the illustrious Duke of Bridgewater, " justly styled the father of British inland navigation," commenced his canal, which was finished in 1776. This successful experiment was speedily followed by numerous companies ; and within fifty years, more than one hundred canals have heen made in England, the total extent of which is 2682 miles, and cost upwards of 132 millions of dollars, which yield anaverage income of over

ten per cent, on the investment, and many of them a much greater profit.

The canals and hydraulic works, in the north eastern district of Holland alone, between the Dollart and the Scheldt, have been estimated to have cost 1,332,000,000 dollars.

In Russia, since the accession of Peter the Great to the Imperial Throne, inland navigation has been so far extended, that goods can be conveyed from the frontiers of China to St. Petersburg, a distance of 4472 miles, with a land carriage of only sixty miles; and from Astracan, on the shores of the Caspian Sea, through a tract of 1434 miles.

Such are the triumphs of genius and enterprise, within the brief period of our national existence.

As it is possible that the height of the summit level, between Boston and Connecticut River, and the tunnel, through Hoosack mountain, may be deemed insuperable objections, to the construction of the canals, which have been recommended, it is proper, and may be interesting, to state, as conclusive precedents, to warrant the opinions, which have been hazarded, what has been achieved, or projected, through districts of country, whose features are of equally as bold, and forbidding a character.

The summit level of the canal of Burgundy, which unites the Soane to the Seine is 888 feet in height.

The Canal of Forez, between the Rhone and Loire, part of which has been completed, under the name of the Canal of Givers, has a summit level which is 1211 feet above the Rhone.

In New Jersey, the Morris Canal, which is destined to connect the Delaware with the estuary of Hudson's River, has been commenced, and the work is rapidly progressing, the summit level of which is 888 feet above the tide waters of the Passaick.

The projected Chesepeake and Ohio Canal is 350½ miles in length, and the rise from tide water, in the Potomack, to the summit level is 2296½ feet; and the descent to the Ohio is 1540½, making the total lockage 3837 feet.

Although tunnels were made at an early period, particularly by the Romans, in the course of the long and expensive aqueducts, which were formed for supplying the imperial city with water, the first that was constructed, for the purposes of navigation, was in France, near Bezieres, on the Languedoc canal. Many others have since been made in that country. They were introduced into England by Brindly, the able engineer of the Duke of Bridgewater's canal, and nearly fifty have since been constructed, on the various lines of canals in that kingdom.

On the Worcester and Birmingham Canal, are five tunnels, four of which are upon the summit pound. The principal one is 2700 yards long, and the aggregate length of all is 3800 yards.

On the Hereford Canal, which is but eighteen miles in length, are three tunnels, viz. that of Oxen Hall, of 2192 yards; Canan Frome, 1320, and one near Hereford, 440; whole length of tunnels, 3952.

The tunnel at Sappertan, on the Thames and Severn Canal, is 4300 yards in length.

The Grand Trunk Canal has five tunnels on the main line, whose aggregate length is 5,179 yards.

There are two tunnels on the Grand Junction Canal, the united length of which is 6125 yards.

The aggregate length of the three tunnels on the Dudley Canal, is 7,325 yards, or four miles, and nearly fifty-one rods.

The tunnel on the Huddersfield Canal is over three miles in length, besides the headings, which

are three quarters of a mile; and the whole has been excavated through rock. This is the largest tunnel in England. The whole length of the canal is but nineteen miles and three quarters; and besides the tunnel, there are 73 locks, which is nearly four to each mile, embankments, deep cuts, and several artificial reservoirs, one of which is 70 feet deep.

In France, on a canal only 32 miles in length, uniting the Somme to the Scheldt, are 2 tunnels; that of Tronquoi, of 1191 yards, and that of Riqueval of three miles and 1026 yards; aggregate length over four miles and a quarter. When this canal was first undertaken, Laurent, the Director General of the work, had projected a tunnel *seven miles* in length, which was commenced, and considerable progress made, during several years, in its excavation; but, on a subsequent survey, it was ascertained, that, by pursuing a different line, the long tunnel could be avoided, by the substitution of the two above named, and the canal was thus completed in 1810.

On the Juniata Canal, which is intended to open a communication between Philadelphia and Pittsburgh, a tunnel is required, four miles in length, the bed of which will be 860 feet below the apex of the mountain.

After the success which has attended these stupendous experiments, so honourable to the countries, in which they were made, it can no longer be doubted that the same enlightened policy and enterprize, will project and execute works of as Herculean a character in the United States

In Great Britain, *inclined planes* have been substituted for *locks* and *tunnels*, to pass elevated ridges, on various lines of canals; and one is now

constructing in New Jersey, as an experiment. If this mode of surmounting summit levels shall be found to answer the purpose, completely, which is very doubtful, it will very much dimish the expense of constructing canals, through mountainous regions, and will, indubitably, be a subject of special inquiry, whenever any are located in this State.

It has been seen, that as empires have advanced in civilization, intelligence, and wealth, the facilities of intercourse have been rapidly extended, by roads and canals; and from *effects*, they became the most powerful *causes* of national prosperity. Among the nations of antiquity, we have the examples of Egypt and Chaldea;—of all ages, populous China; and in modern times, of Venice, Holland, France, Great Britain, and our own country; but except China, and the three latter nations, from the peculiar constitution of their surfaces, the labour of forming lines of inland navigation was unattended by any of those difficulties, which are to be surmounted, by their successors, in the career of agricultural, mechanical, commercial and political aggrandizement.

While external commerce was chiefly confined to the Arabian gulf, the Mediterranean and Euxine, the progress in the arts of civilization was slow, and they only approximated towards that exalted state, which they have now attained.

The discoveries of Columbus, and the voyage of Vasco de Gama, have wrought as great changes in the political world, as the researches of Copernicus, Galileo and Newton have, in the scientifical. The human mind appears to have expanded as the sphere of its action has been enlarged; and the governments of nations, participating in the more

enlightened views, by which individual enterprise is directed, have induced a policy, which quadrates with the progressive genius of the age. Instead of a few neighbouring kingdoms, the whole globe has become the field of commercial adventure; and now, as during all time, the most successful competitors in navigation, among the nations, are the most prosperous and renowned; not directly from that cause, but agriculture, and the mechanical arts, have been simultaneously encouraged, to meet the demands of such a boundless interchange of products; and the reciprocal benefits to the farmer, manufacturer, and merchant, from the lucrative industry of each, have, as alternate causes and effects, produced a general result, highly beneficial to all classes of society.

An amicable and unrestrained rivalry, in the three great branches of national industry, with the generous understanding, that all must be flourishing, to insure the success of either, is an axiom in political economy, which has been sanctioned by the ablest statesmen, and has not only become the basis of statistical jurisprudence, in Great Britain and the United States, but also of international regulations. Antiquated and deleterious customs, visionary theories, for the regulation of individual enterprize, and the ruinous systems of exclusive monopolies, have been rapidly abrogated, in one European kingdom, and become the subject of profound inquiry in another.

It is notorious, that foreign commerce, even in Phœnicia, Athens, Venice and Genoa, could not have given them that exalted station, which each in its turn assumed, although each of those nations might be said to have been included within the walls of their emporia; but they were as distinguished for their rich manufactures, as for their maratime su-

premacy; and when the tillers of the soil harmoniously confederate with those great interests, the system of private and public wealth—of individual happiness, and general prosperity—for the diffusion of intelligence, and the foundation of national glory, is rendered perfect. But, to accomplish this, the rights of every portion of the community must be respected, fostered and secured. We must then profit by the light of history, the experience of nations, and the instructive results of the gigantic efforts which have been made, or are in progress on the other side of the Atlantic, and most of the States in the Union, for the extension of internal improvements; and thus advance the prosperity of every individual, in each section of the whole Commonwealth. This is a measure, in which each citizen must feel the deepest interest; for, immediately and directly, it will be beneficial, in a pre-eminent degree, to the farmer and manufacturer, and ultimately swell the amount of exports and imports of the merchant; and it deserves the most grave and deliberate consideration, whether the former class of citizens, constituting, by far, the largest portion of the population of the Commonwealth, have not a right to expect that the Legislature would adopt such measures, as shall afford those facilities, which will enable them to successfully compete with the agriculturists of other States, who, by natural or artificial internal navigation, can send their products to a market, at an expense, not greater, than is done by those in the county of Worcester, although three hundred miles more distant. The transportation from Buffalo to Albany, a distance of 362 miles, being from nine dollars and five cents, to ten dollars and eighty cents, per ton; or about half the expense of sending a like weight from Connecticut River to Boston. But whatever

is the distance, it costs the farmer and manufacturer, but one twentieth as much for canal, as for land transportation.

These are not hypothetical statements, but the actual results of experiments which have been made, in this country and in Europe. But it may be asked, with considerable propriety, will all our farmers and manufacturers, be equally benefitted by the line of canal, which has been recommended? and this is the answer. It has been demonstrated that the transportation on canals, is as twenty to one over the best roads; it is therefore apparent, that they should be universally constructed. But they are expensive; require many years for their completion, and consequently cannot be simultaneously undertaken. There must then be a First Step, and this, as in all other momentous undertakings, is the most difficult, but at the same time, the most important and conclusive, as to the final result. How have our roads been made? not all at once; but as the wants of the people required, and their means would warrant; until, in Massachusetts, they have become the admiration of the Union. The same course must be pursued as to canals. Let the most important be first constructed by common consent, the concurrent approbation, and said of the whole state; with an express understanding that the work shall go gloriously on, until every section of the state is traversed by these new *Highways*, of intercommunication. The execution of the first, will, as a precedent, ensure the location of others, in the order of their apparent usefulness and importance; and, what is of still greater moment, if the State undertakes the labour, furnish the means for their construction, as the income, from tolls, will constitute a perpetual and annually increasing fund, which should be exclusively appropriated to the purposes of internal na-

vigation; and this is a cogent reason, why one route should be now selected, and the work commenced as soon as possible.

To bring this theory to the stern test of facts, it is only necessary to advert to the practical results, which the canals in New-York, abundantly furnish.

In the last report of the Canal Commissioners of that state,—and we are bound to repose the most implicit confidence in their anticipations of the future, from the surpassed realities of their former predictions,—it is stated, that the whole of the debt incurred for the construction of canals, will have been extinguished in 1836, by the canal fund, and tolls,—being a period of only ten years, from their completion, "and leave an annual and increasing revenue of 1,525,000 dollars." They further report, that, "pursuing the same mode of calculation, for the next ten years, after 1836, and the Erie canal will produce, at the end of that period, an annual revenue of 2,000,000 of dollars; in ten years thereafter, 4,000,000," and in 1876,—fifty years from the date of its completion, of 9,031,176 dollars; a sum nearly equal to the whole cost of the Erie and Champlain canals.

It will naturally be inquired, have we a right to anticipate equally as flattering results, from the like undertakings, in Massachusetts? And why not? The line of navigation on the Erie Canal, was not completed to the Lake, until last October, of course the whole traffic was supplied by the country, on its immediate borders; and that was sufficient to yield a revenue in 1823, on 160 miles, of $105{,}037\frac{35}{100}$; in 1824, on 280 miles, of $294{,}546\frac{62}{100}$; and in 1825, when the entire route was navigable for only the last month of the season, during which boats pass, of 500,000, dollars, which is more than the interest, on the whole sum, which has been expended, on the Western and Northern ca-

nals; and exhibiting an increase of 205,453$\frac{38}{100}$ dollars over the last year.

On the Champlain canal, the tolls, during the year 1824, exceeded the interest of the sum expended in its construction, and it is calculated that the revenue from tolls, will probably be trebled within ten years.

When a canal shall have been constructed to the Connecticut, it is not the mere transportation, which the adjacent country will afford, on which reliance is to be reposed for an income from the tolls, but the population of the fertile borders of that river, for more than one hundred miles, will send their products through this channel to the sea-coast, and receive in return, those of all countries, to be found in the capital; and many of the members of the Legislature are happily enabled to estimate the present extent of land transportation, on the great diverging roads from Boston to the Nile of New England.

By information recently received, from a gentleman who had been requested to ascertain the fact, it appears, that 14,600 waggons pass annually over one of those great routes, carrying, upon an average, one ton each.*

Thus far the subject has been considered without reference to an improvement of the navigation of the Connecticut, which, during the past summer, has claimed the special attention of the National Government, and of the States of Vermont, New-Hampshire and Connecticut. Surveys have been made from the source of the river to the ocean, with a view, not only to ascertain, in what manner the various obstructions in its channel can be removed, but how far the line of navigation can be extended north and laterally, by canals.

The engineer, in the employ of the United States, has ascertained, that a canal can be easily

* See Appendix, No. 38.

constructed from near Burnet, in Vermont, on the right bank of the Connecticut, to Lake Memphramagog, and from thence a water communication opened to the St. Lawrence, by ascending up the Clyde and through Island and Spectacle Lakes, to the river St. Francis, which falls into Lake St. Peter, an expansion of the river St. Lawrence, nearly midway between Quebec and Montreal. The obstructions to the latter section of this line of navigation, are not very considerable, as there has been an intercourse by boats, between the frontiers of Vermont and Quebec, in that direction for many years.

In the State of Vermont several canal routes have been explored, for connecting Lake Champlain with Connecticut River; and there appears to have been excited, a spirit of enterprise, which sanctions the belief, that the project will be effected, probably through the valley of Onion or Le Moelle River, and thence down the basin of White or Wells River.

There are 260,000 inhabitants in Vermont, and the number is rapidly increasing, as 110,000 have been added since the year 1800. More than one hundred manufacturing companies have been incorporated; agriculturing improvements are advancing in every section of the state, and increasing attention is bestowed upon the rearing of sheep.

The favourable effects which the Champlain Canal has produced on the western side of the Green Mountains, have been so astonishingly great, that the citizens who live on the opposite side are emulous to participate in similar benefits, by the construction of canals to, and the improvement of the navigation of, Connecticut River, which laves the whole eastern borders of the state. They have seen, since the New York northern canal has been

opened, that articles are sent and brought from Albany, for five dollars per ton, the transportation of which, during the war, cost one hundred dollars.

Marble of the finest quality, which had remained unwrought in the quarries, is now a great staple of export, much of it being first sawed and polished for various purposes, giving employment to numerous labourers.

The modes of transacting business is changed, and new vocations required. Instead of driving their beef cattle to a distant market, they are slaughtered within the state, and there packed, as is their pork, thus giving employment to various classes of mechanics, and retaining those profits, which were before enjoyed elsewhere. The coopers find a demand for their casks; the hides are tanned, and the tallow made into candles and soap, within the State. The farmers on Connecticut River, and the borders of the proposed canal, will readily perceive the advantages which will derive to them, from this single change, in the mode of disposing of their justly celebrated fat cattle.

In Strafford, nine miles distant from Hanover Bridge, copperas has been manufactured for several years. During the present, it is estimated that one thousand casks, containing seventeen hundred pounds each, will be made; and if the expense of transportation, which is now from fifteen to twenty dollars per ton, is lessened, by the improvement of the navigation of the Connecticut, and the construction of a canal, two thousand tons would annually be sent to Boston; as one of the owners of the establishment states, in a communication to the Commissioners that as large a quantity could be made, and, that "the increasing consumption of the country will soon render it necessary."

Pot and pearl ashes, constitute one of our great staples of export, and, of which, large quantities are made in Vermont but owing to the distance and expense of land transportation, they are chiefly sent by the way of Memphramagog, and other channels, to Montreal and Quebec. From a statistical account of the trade of the latter city, it appears that 60,000 casks have been exported to Great Britain during the last season; 40,000 *of which were received from the United States;* and it was estimated that the average amount which each cask of ashes left in Canada, during its progress, was not less than three dollars and seven cents, producing an amount of money circulated in that country, on that one article, of 122,800 dollars.

In New Hampshire, which is bounded on the west, for its whole length, by Connecticut River, the same zeal has been aroused for the extension of inland navigation, which has been evinced in the adjoining State. Surveys have been made for connecting Piscataqua, Merrimack, and Connecticut Rivers, by the waters of Winipiseogee and other lakes.

There are numerous iron mines in this State, and two have been wrought, pretty extensively, in Franconia; the operations, in one, however, have been suspended; but, if the canal is made to the Connecticut and the obstructions in the channel of that river removed, a side canal, through the valley of the Ammonoosuck, or a rail-way, the appropriate purpose of that novel and valuable appendage to canals, will soon be formed, from Franconia, and render those almost neglected beds of rich ore, great sources of wealth to the proprietors, and add very considerably to the traffic on the canal; to which all that part of the State, north of Winepi-

seogee Lake, will be tributary, besides the southern section, which slopes to Connecticut River.

It has been stated, in the account of the reconnoisances, that there were extensive slate quarries near the mouth of Miller's River, on the right bank of the Connecticut, and mines of iron and copper, in the vicinity, which will claim attention, whenever a canal is constructed.

The numberless hydraulic powers which the Nashua and Miller's Rivers afford, have already induced the establishment of many manufactories, and including those on the Connecticut, and its numerous branches, it cannot be doubted, that they embrace the sites of the future Manchesters and Birminghams of the north.

It may be safely calculated, then, that a thickly populated, fertile and flourishing section of country, at least twenty miles wide, and more than two hundred in length, will be immediately tributary to a canal; and how rapidly will the trade increase, when such facilities as have been contemplated, are given to transportation, through regions of quite as great an extent.

Agriculture will receive a stimulus, which will surpass the anticipations of the most sanguine. The primitive forests, which shade the declivities of our mountains, will descend to the sea coast, as the materials for the construction, or as the lading of the fleets of commerce, besides supplying the vast consumption of lumber, for public and private structures, and the various mechanic arts. At present, they are deemed useless incumbrances, and as agriculture advances, they perish in the general conflagration, which precedes the cultivation of the soil. The little value that is attached to the majestic forest trees of the interior, and their great source of wealth to the proprietors of the land,

when not too remote from a market, cannot be stronger illustrated, than by the reply of a farmer, from the vicinity of Niagara, who was profitably disposing of a cargo of timber at Albany. Being asked what it was worth to him, *before* the Erie Canal was completed, answered NOTHING. And how many other natural products, and how many that would be created, in the regions that have been named, are, from the same cause, of no value. An infinite variety of articles, which are unknown to the inhabitants, will be discovered, or manufactured, when the loudly-demanded facilities of transportation are realized.

Being satisfied that public convenience requires, and that the traffic on a canal from Boston to Connecticut River will yield a revenue greater than the amount of interest on the sum which will be expended in its construction, there can no longer exist any objections to the immediate commencement of the work; and most of the reasons which have been assigned, in favour of the establishment of that line of internal navigation, are equally as conclusive for its extension to the Hudson; while numerous others, both of a local and general character, rush upon the mind, with such imposing majesty and dominating preponderance, as to produce the cheering conviction, that the present generation will not have passed away, without having witnessed the accomplishment of that momentous state and national project.

The state of Ohio has commenced the construction of a canal from the mouth of the Sciota River to Lake Erie, and when that line is opened, (taking it for granted, that before that period, one will be from Boston to the Connecticut,) the only impediment to an inland navigation from the capital of Massachusetts to New Orleans, a distance of more than 2600 miles, will be the short route of

seventy-eight miles from Connecticut River to the Hudson ; and can it be presumed, that such, a comparatively small barrier, will be suffered to exist, when its removal will connect Massachusetts Bay with the Gulph of Mexico, and secure a safe, certain, expeditious, and cheap intercourse, with all the states and territories, bordering upon the Ohio, Mississippi, Missouri, the great lakes and their tributary rivers ? Some idea may be formed of the glorious results which may be anticipated, from such a prolonged line of interior navigation, when the canal commissioners of New York speak thus confidently of the effects, which the completion of the western canal will produce.

" The immense country contiguous to the great western lakes, is now only in an incipient state of improvement. The boundless forests have hardly begun to recede, before the march of human industry."

" The population of the United States doubles " in twenty-five years ; although many of the old " settled parts continue to be nearly stationary. " This rapid accession to our numbers is principal- " ly created by emigration ; by the establishment " of towns, and villages, and cities, in the wilder- " ness ; and, after the connection of the canal with " the Erie, no part of the earth can offer stronger " invitations to the enterprising emigrant, than the " west. A temperate climate, and an uninterrupt- " ed chain of water communication to the ocean, on " which may be conveyed the productions of dis- " tant countries, and of other climes, in return for " the surplus growth of a prolific soil, are among " its peculiar advantages. An immense tide of " population will set to the west, and after over- " spreading the extensive borders of our inland " seas, it will throw back upon our great commer-

" cial emporium, and upon our inland cities, a cor-
" respondent reflux of wealth and prosperity."

" The western part of this state, and the regions
" still farther west, whose supplies and surplus
" productions will traverse the Erie Canal, contain,
" at this time, a population which cannot be esti-
" mated at less than a million. This population,
" possessing such peculiar advantages, both by
" nature and art, will probably double every ten
" years, for the next thirty years; so that those
" who witnessed the commencement of the Erie
" Canal, may, at the termination of that period, see
" the productions and supplies of eight millions of
" their fellow citizens floating upon its waters."

It is but to name these overwhelming facts, to convince incredulity and refute objection; for the facility with which the connexion of such vast commercial channels can be effected, and the incalculable benefits which will result therefrom, are so apparent, that dilatory scepticism cannot doubt, and phlegmatic indifference must joyfully anticipate, their realization. To Massachusetts, how important then is the speedy extension of a line of canal to the junction of those of Erie and Champlain. How interesting to Boston, the second commercial emporium of the republic, and for enterprise surpassed by none. Without rivalling, it may harmoniously participate with the city of New York, in that trade, for which the canals of that state will be the thoroughfares of nearly half the union.

From Troy, the distance to Boston and New York is nearly the same, and in the abundance and variety of the products of agriculture, the forests and the mines, which will descend from the immense regions of the west, many may find a preferable market in the former city; and numerous

articles of domestic industry or foreign importation be there procured, in return, on more eligible terms, which commends the creation of a second Atlantic entrepot.

The intercourse by sea and the Hudson, with Albany, is long, dangerous and expensive, even in peace ; and during war, subject to nearly total interruption.

It is a well known fact, that this state is, to a great extent, dependent upon those of the middle and western sections of the United States, and New York, for flour ; the imports into Boston, alone, during the year, ending on the first of November last, were 243,937 barrels, of which 36,499 came from the state of New York ; and as that of Genessee now has the preference, from its superior quality, Massachusetts will be a great and increasing mart for that abundant product of the state of New York.

Circuitous as is the line of communication with Albany and Troy, the trade is very considerable with the sea ports of Massachusetts, New Hampshire and Maine.

During the year, ending on the first of November last, thirty-four vessels arrived at Boston from Albany, laden with flour, grain, whiskey, ale, butter, furs, leather, pot and pearl ashes, beans, peas, alcohol, pork, lard, wool, bacon, stoves, flax, salt, marble and numerous other articles; and during the same period twenty two vessels sailed from Boston to Albany, laden with fish, hops, glass-ware, rum, molasses, tea, domestic goods, tobacco, earthen ware, hard ware, nails, iron, pepper, raisins, hides, oils, packages of foreign merchandise, sugar, lemons, shoes, chocolate, steel, paper, wine, dye-woods, iron-castings, soap, paints, powder, and an infinite variety of other foreign and domestic products.

But besides the direct trade many articles which

are sent first to New York, from Boston and Albany, ultimately reach both of the latter cities; while Newburyport, Gloucester, Salem, Marblehead, Barnstable and in fact all the sea-ports of the state, have an extensive trade with Albany, Troy, Waterford and other towns on the Hudson. By information from the several Custom Houses between Cape Cod and Merrimack River, it appears that 65,313 quintals and 11,608 barrels of fish have been sent up the North River, and chiefly to Albany, during the last season; and the demand is annually increasing.

The expense of transportation from Albany to Boston, by coasters, including the cost of landing the cargoes from the canal boats at Albany, storing, re-shipping and insurance, is about the same it would be, on a canal from Troy. The extra price obtained for the produce in Boston and the reduced cost of the merchandise obtained there, compared with Albany, and the impracticability of the canal boats proceeding to New York, will necessarily give many of them a direction through the Massachusetts canal; for instead of the delay and expense of re-shipping the cargo at Albany for New York and awaiting the return of the proceeds, the owners will often find it for their interest to continue on to Boston, which will eventually become the entrepot of the trade of all the ports in the State, as well as of those of Maine, which is now divided between those ports and Albany.

In addition to the interior lines of navigation, with the western lakes, which have been named, a company has been incorporated in the state of Illinois, for constructing a canal, to connect the waters of Lake Michigan with those of Illinois River; and from the surveys which have recently been made, it is ascertained that the project can be

effected without difficulty, at an expense of from only six to seven hundred thousand dollars.—The route is through the valley of Chicago River, which falls into the Lake and that of Des Plaines, which, uniting with the Kan-ka-kee, form the Illinois ; and thence down that river to the mouth of the Little Vermilion, from whence the Illinois is navigable. for boats, to the Mississippi, a distance of over 300 miles.

The whole length of canal will not exceed sixty miles, and the surface of Lake Michigan having been ascertained to be 157 feet above the water level of the Illinois, at the mouth of the Little Vermilion, the whole lake will become the reservoir, for supplying this interesting line of navigation.

The state of Illinois abounds in the most prolific lead mines, as do the borders of the Upper Mississippi ; and those regions are destined to supply the whole United States with that important article, and also with copper, numerous mines of the latter having been there discovered, as well as on the western shore of Lake Superior; and inexhaustible mines of iron ore, of an excellent quality, are found in that extensive district of country, particularly in the states of Illinois and Missouri.

The quantity of lead made on the right bank of the Mississippi, between the mouths of the Missouri and Illinois, is already enormous. There arrived at New Orleans, in the various forms of pigs, bars and shot, during the two years which ended on the first day of October last, 7,500,000 pounds, exclusive of the great amount consumed in all the states and territories bordering on the Mississippi, Missouri and Ohio.

A considerable portion of the fur trade of the Lakes, and of the uninhabited regions, extending

to the Rocky Mountains, will take the direction of the Erie and Massachusetts Canal.

Before the year 1812, the whole navigation of the appropriately denominated "Mediterranean Seas of America," consisted of some 2 or 3 small sloops. They have since been renowned for the naval victories achieved upon them, and are now traversed by hundreds of vessels, and among them are some of the largest class of steam boats. Light-houses have been erected along their shores; and Black Rock, Buffalo, Erie, Sandusky, Detroit, and even Michilimakinack, the ports of Green Bay and the Sault de St. Marie, have the appearance of maratime emporia, which leaves not a doubt, that the lakes are destined to become as distinguished for the commercial fleets that will navigate them, as they are for their number, extraordinary size, and location.

In the account of the reconnoisance of the route, from Connecticut River to the Hudson, it was stated, that mines of iron, lead and copper, and quarries of lime, slate and marble abounded, near the mouth of Miller's, and on the banks of Deerfield and Hoosack Rivers; while the valuable hydraulic privileges on the two latter, and their tributary streams, cannot fail to be converted to the purposes of manufactories; and the forests, agriculture, and a more numerous population, will furnish their accumulated products, to be wafted down this new channel, to the ocean.

From the State of New York, a "cordial co-operation" is to be anticipated, as will be perceived, by the following extracts from a communication, from His Excellency De Witt Clinton.

"I am happy to perceive the disposition manifested by your State, to cultivate the great interests of internal improvement, and I can assure you, that

any assistance that I can give, any aid that I can render, officially or individually, shall be entirely at your service.

"I am persuaded that the Legislature of this State, will afford you all proper facilities, in favour of your laudable undertaking; and, considering, as I do, the multiplication of markets, and the facilitation of communication, as highly conducive to the general prosperity, I have no hesitation in assuring you of my cordial co-operation."

The deep interest, which the citizens of Troy, of the northern part of the County of Berkshire, and of the County of Franklin, take in the construction of a canal to the Hudson, is evinced in the correspondence appended to the report.

Having attempted to illustrate the practicability and importance of locating canals on the designated lines, it may be expected that the means for defraying the expense of their execution, should be suggested, which it is anticipated are ample, within the controul of the State, and can be furnished without the imposition of very onerous exactions upon the citizens; and, as the whole expenditure will be for their immediate benefit, and future prosperity, the fullest confidence is reposed in their public spirit, liberality and patriotism, to meet the requisitions of the Legislature.

Doubting whether a work of this extensive, permanent and costly character, which is calculated to have such a powerful and lasting influence upon the great mass of the people, and involving so many interests, of a local, private and public nature, should be accomplished by an incorporated company, the Commissioners have, on mature reflection, come to the conclusion, to suggest the expediency of its being undertaken by the State. As the whole object is ultimately to facilitate the inter-

course between all parts of the Commonwealth, and extend it to other sections of the Union, not for the purposes of speculation, or pecuniary profit, but to subserve the general weal, the controul should be ever kept within the power of the State Authorities, who will diminish the tolls, and consequent expense of transportation, as may be found expedient; while the surplus revenue, beyond the annual repairs and expenses, after the debt, which shall have been incurred, is extinguished, can be appropriated to the construction of other lines of internal navigation, and thus render the first effort, a future, perpetual, and increasing source of means, for that purpose.

There can be no difficulty in negotiating loans, on the credit of the State, to meet the whole expenditure, on very reasonable terms, provided a fund is established, and exclusively pledged, for the payment of the interest, and, ultimately, with the tolls, constitute an income for the liquidation of the debt.

It is proposed, that the Canal Fund be constituted from some, or all, of the following items; a portion of which are immediately available, and the others, most probably, will be realized.

1. The tax on the Banks.
2. Duties on Auction Sales.
3. Proceeds of the sale of Public Lands.
4. A State Lottery.
5. Interest on the invested amount of claims for militia services, which may be paid by the National Government.
6. Canal Tolls.

Before the year 1812, the revenue of the Commonwealth was, almost exclusively, derived from the general State taxes; but, during that year, a tax was imposed upon banks, and in 1823, another

upon auction sales, both of which, being extraordinary and specific sources of income, operating indirectly upon the people, there may not be any serious objection to pledge them as a portion of the Canal Fund; or, at least, the excess of each over the receipts of 1824.

The tax upon banks, for 1824, amounted to $123,040\frac{50}{100}$, and for 1825, to $144,643\frac{86}{100}$.

The duty upon auction sales, for the two last quarters of 1823, the first year of its imposition, amounted to $13,201\frac{91}{100}$; for 1824, to $27,815\frac{15}{100}$, and for the two quarters, ending May 31, 1825, to $24,168\frac{14}{100}$.

Public Lands.—The estimated number of acres of land, which belonged to Massachusetts and Maine, situated in the latter State, in March, 1821, was 11,342,548

Since that period, there have been divided by the Commissioners, 1,933,686 acres—portion to Massachusetts, 951,122

Number of acres undivided, 9,408,868 one half of which belongs to Massachusetts, 4,704,434

Total number of acres which belong to Massachusetts, 5,655,556

Number of acres sold or granted for various purposes, 564,029

Total number of acres unsold, 5,091,527

The amount of the proceeds of public land sold since May 1, 1823, is $78,402\frac{61}{100}$ dollars.

The value of the whole quantity of land remaining, divided, and undivided, it is difficult to ascertain. From enquiries made at the Land office, it appears, that some of that which has been sold, in

small lots and in the best situations brought 75 cents per acre, but generally all prices from ten to 50 cents have been paid. The Agent is of opinion, that when whole or half townships have been disposed of, the average price has been about 25 cents per acre. Assuming that sum as the value per acre of the 5,091,527 acres, still owned by the state, it is worth 1, 272, 881$\frac{75}{100}$ dollars.

Lottery. Enquiries have been prosecuted, to ascertain the sum annually expended, in this state for the purchase of lottery tickets, and from the best information which can be obtained, there is no doubt, that it amounts to over 250,000 dollars; and this large expenditure has been made, when there is a law of the Commonwealth prohibiting the traffic altogether; which shews conclusively, that the public voice is against legislative interference, or restraint.

Having been arranged under the generic term "*gambling*," an effort has been made, from the purest and best motives, to discountenance and suppress lotteries; but it now becomes a serious question of investigation, whether too harsh an epithet has not been given to one of the ordinary modes of raising funds, under the sanction of the highest legislative enactments, both in Europe and this country, for literary, eleemosynary, and various other great and excellent purposes. If it has been proved that the legal countenance, which this state has *formerly* given, still induces a disregard of existing statutes, is it not more politic, so to amend them, as shall secure to the Commonwealth those benefits which are now derived by other States?

It may be said, with sufficient plausibility, that if an unabatable evil does exist, let it be converted to the best possible purposes. All constructive crimes, including such as come within the anti-

quated systems of sumptuary jurisprudence, are not deemed, by the people, as immoral, *per se;* and it is an axiom in ethics, as well as legislation, that doubtful or imaginary offences should not hastily be made penal; for the public voice will preclude the possibility of enforcing the execution of the laws; and even the bench, *knowingly* forget, that they are in the statute book. This is notoriously true, as it respects Great Britain, and numerous instances could be cited, in this state, where the spirit and letter of the law have been dead, long before the dignity of the Legislature was restored by its repeal.

The Commissioners would be the last among their fellow citizens to sanction immorality, or impair the omnipotence of justice; but with deference offer such remarks, as may tend to the developement of truth; the confirmation of what shall be found salutary; and the rejection of that which is supererogatory, in our generally, most excellent code of laws.

Should a lottery be resorted to, as one of the means of raising funds, it can be affirmed with confidence, that, twenty thousand dollars may be thus, annually obtained, and probably a much greater sum.

Claims for Militia services. The whole amount of the claim, on the General Government, for Militia services was $ 843,483,77

There has been paid $ 11,000,00

Balance unsettled $ 832,483,77

There appears to be a sanguine expectation, on the part of the Agent, who is charged with the adjustment of this claim, that the whole will be speedily paid, which if invested in the public funds

would yield an annual interest of 49,949$\frac{8}{100}$ dollars.

Canal Tolls. The amount of revenue which will be derived from the canal tolls can only be approximately estimated. As the tolls on the Erie Canal, when only 280 miles were completed, amounted to 294,546 dollars, the section between Boston Harbour and Connecticut River, should yield over 100,000 dollars; but the tolls collected on the Erie Canal were derived from the traffic which the country on its immediate borders alone furnished, whereas the whole of the Connecticut River, above the debouche, and some distance below, will be tributary to the canal, and may be said to more than double its length, and consequently increase the revenue to 200,000 dollars; and when the line is extended to the Hudson, taking into consideration, the increased population of the country, and the business which the canal will have created, the income, within three years thereafter, cannot be less than 500,000 dollars.

Whether it will be most advisable to commence the construction of the two great sections of the canal line, from Boston to Hudson River, simultaneously, or complete that to the Connecticut River first, may depend upon the funds which can be commanded, without increasing the annual expenditures of the state, beyond reasonable and facile limits. The former course is most desirable and it is more than probable, that the Legislature will, in the true spirit of the times, make a grand and decisive movement, commensurate, with the importance of the object to be attained.

If the items of revenue, which have been named, should be realized, and exclusively appropriated, for constituting a Canal Fund, the following will be the result.

1. Tax on Banks	144,643,86
2. Duty on Auction Sales for 1827	50,000,00
3. Income from sale of Public Land estimated at 3 per cent. per annum	38,186,45
Lottery	20,000,00
Interest on funded Militia Claims	49,949,02
	$ 302,779,33

As several of the items included in the proposed Canal Fund, are hypothetical, and if the Legislature should consider it inexpedient, to make up the deficiency, as well as the one occasioned by the withdrawal of the income from the Banks and Auction sales, by an increase of the annual state tax, there is another more certain and less exceptionable mode of providing funds, for the commencement and speedy completion of the canal to Connecticut River, and ultimately, to extend it to the Hudson, without the requirement of any very extraordinary effort on the part of the people.

The cost of constructing a canal to Connecticut River has been estimated at 3,000,000 dollars, and if it is completed, in three years, it will require an income to pay the interest on the loans of $50,000 for the first, $100,000 for the second, and $150,000 for the third year.

The balance in the Treasury at the close of the year 1824, was 29,579 $\frac{68}{100}$ dollars, and it may be safely calculated that the future annual balance will be quite as large, if the deficit occasioned by the non-imposition of a tax, for 1825, is made up by doubling the tax for 1826. The excess of the auction tax, over the amount received in 1824, will, after 1826, amount to at least 23,000 dollars, and the Lottery will yield 20,000 annually. If in addition to these sums there is an extra tax of

59,992$\frac{50}{100}$ dollars in 1829, when the canal will be completed, there will be a sufficient revenue obtained, to meet the interest on the loans, as the following table will exemplify.

First year. 1827.	Balance in the Treasury at the close of the year 1827.		29,000
	Excess of Auction Duties		23,000
	Proceeds of Lottery for 1826	20,000	
	Interest on do. at 5 per cent.	1,000	21,000
	Proceeds of Lottery for 1827		20,000
			$ 93,000
	Interest on Loan of 1,000,000		50,000
	Excess of Income for 1827		43,000
Second year 1828.	Interest on do.		2,150
	Balance in the Treasury 1828		29,000
	Excess of Auction Duty		23,000
	Proceeds of Lottery		20,000
			$ 117,150
	Interest on loan of 1827, 50,000		
	do. do. 1828, 50,000		100,000
Third year 1829.	Excess of Income for 1828		$ 17,150
	Interest on do.		857,50
	Balance in Treasury 1829		29,000
	Excess of Auction Duty		23,000
	Proceeds of Lottery		20,000
	Additional tax		59,992,50
			150,000,00
	Interest on loans of 3,000,000		150,000,00

The additional tax of $59,992$\frac{50}{100}$, will only be required for the year 1829, as the revenue, from the canal tolls, will be more than sufficient, with the

permanent annual income of the canal fund, to defray the interest on the loans, and constitute, with them, a sinking fund, for the extinguishment of the debt.

It should be recollected, that if any income, from either, or all, of the other first mentioned items, which were proposed for the constitution of a canal fund, are, in the mean time, available, no extra tax may be requisite.

The portion of the annual tax, paid by Massachusetts proper, for several years, previous to the separation of Maine, and for the first year after that event, was $104 515$\frac{88}{100}$; but for 1822, 23, and 24, it has been $75,000, being $29,515$\frac{88}{100}$ less; and deducting this sum from the assumed tax for 1829, of $59,992$\frac{50}{100}$, would leave an extra tax of but $30,476$\frac{62}{100}$; or less than a third of what was paid in 1796, when the population was not more than 400,000, and it is, probably, now 550,000; or as eleven to eight; while the increase of wealth, and consequent ability of the people, to meet the tax, is nearly as two to one.

The aggregate of the income of the Commonwealth, established as the basis of taxation, in 1820, was $9,218,656$\frac{99}{100}$; the extra tax of $30,476$\frac{62}{100}$, would, therefore, be less than three mills and a third on the dollar.

At all events, no extraordinary effort, compared with the grandeur of the object, will be required, to construct a canal to the Connecticut; and, unless that is soon accomplished, Massachusetts will, inevitably, take a retrogade course. The whole of the trade of the great valley of that river, will be drawn off from the capital, through various channels; when, from the wealth, the distinguished enterprise, and, hitherto, enlightened policy of the Commonwealth, a far different result should be an-

ticipated; and which can, must and will be realized; for there is not a single citizen who will listlessly fold his arms, and witness the degradation of his native land. There are none so heedless, as to behold, unmoved, the most distant indication, of the possible decline of a State, which has, so long, and so meritoriously, maintained such an exalted station, among the confederated republics of the Union. All the other States, are either rapidly maturing plans, for the extension of internal intercourse, or are successfully carrying them into effect. Let us hasten, then, to embark upon that flowing tide of universal enterprise and prosperity, which now makes onward, with such accumulating strength; and guided by that "spirit of improvement which is abroad upon the earth," we cannot fail to be borne triumphantly along,.

The Commissioners having learned, that plans of the surveys, made by Mr. Hills, for General Henry Knox, in the year 1791, of a northern and southern canal route, from Boston to Connecticut River, were in the possession of his heirs, requested the loan of them; and they were kindly transmitted; also a plan of the route of a canal from Barnstable to Buzzard's Bay. It having been suggested, as will be perceived in the correspondence with General Thatcher,* that these maps would be disposed of "on reasonable terms," it is recommended that they be purchased by the state; as well as several others now in the possession J. H. Pierce, Esq. of Boston, relating to the first named surveys, which appear to have been the original great plans, from which the others were projected. The latter have been considerably mutilated, but at a little trouble and expense could be nearly re-

* Appendix, Nos. 23, 24, 25 and 26.

stored. To private individuals, they are not of much value ; but will be found very useful in the location of canals and roads, and in the construction of a large and more perfect map of the Commonwealth, which is so much required.

It is with great satisfaction that the Commissioners express their decided approbation of the efficient manner, in which the Engineer, Colonel Loammi Baldwin, has discharged his very responsible and laborious duties. To great scientific attainments, and a vast fund of intelligence, acquired by the minute inspection of the canals and other public works, within the departments of the civil, military and naval engineer and architect, in Europe and in this country, he has the advantages of great practical experience, derived from many years constant employment, in the successful exercise of his professional skill. Indefatigable, energetic and persevering, he has achieved all that could have been accomplished, during the period he has been employed, in a manner highly satisfactory to the Commissioners, and honorable to himself.

The Assistant Engineer, George R. Baldwin, Esq. modest and unpretending, yet learned, enterprising and ingenious, has so acquitted himself, as to justify the fullest assurance of his future usefulness and distinction.

To the citizens of the numerous towns through which the Commissioners passed, during the various explorations, they are under the greatest obligations for the generous aid, which was most cheerfully offered to facilitate their researches. Many gentlemen had been at considerable expense and trouble, in making preparatory examinations and surveys; and the general spirit evinced by the whole people was such, as to augur the successful

result of that great experiment, which all appeared anxious to see commenced.

To obtain information on several important points, it became necessary to open an extensive correspondence, with gentlemen, residing in various sections of the country; and many of the communications are appended to the report, as justificative of portions of it, or illustrative of the general subject of internal navigation, so far as the interests of this Commonwealth are involved.

Early in November, Committees from Connecticut, and the southwestern part of this State, represented to the Commissioners, that arrangements had been made for exploring the route of a canal from Norwich, up the valley of Quinebeauge River, to intersect a canal line from Springfield, through the basin of the Chickapee to Brookfield, and thence south of the explored Worcester route, to Boston; and that, if possible, surveys would be made, and the results transmitted to the Commissioners, early in January, who were requested to append them to their report; but, in the event, they should not be completed in season for that purpose, it was desired that the subject should be named, with a suggestion, that memorials would, probably, be presented to the Legislature, during the winter session, by the citizens of those sections of both States, who are more immediately interested in constructing the proposed lines of intercommunication.

All which is respectfully submitted.

NATHAN WILLIS,
ELIHU HOYT,
H. A. S. DEARBORN,
} *Canal Commissioners.*

ERRATA.

Page 8, l. 14—p. 6, ls. 3 and 5—p. 28, l. 5—p. 45, l. 25—p. 116, l. 1, and p. 173, l. 20, for reconnoisance and reconnoisances, read *reconnoissance* and *reconnoissances*.

Page 10, l. 10, from bottom, for tapping, read *sloping*.

Page 17, l. 12, from bottom, for intersecting, read *intersects*.

Page 31, l. 14, for termini, read *termination*.

Page 144, l. 3, for declining; read *deducing*

APPENDIX.

CORRESPONDENCE.

NO. 1.

Letter from the Berkshire Committee.

JULY 14, 1825.

Gentlemen,

IN consequence of the late Resolves of the Legislature of Massachusetts, the attention of the citizens of the county of Berkshire, has been drawn to the consideration of the most eligible route, for the contemplated canal, from Hudson's River, to the Connecticut.

Agreeably to public notice, a very respectable meeting, from various parts of the county, was holden at Adams, on the sixth of July, inst. to consider, what measures ought to be taken, to give aid and information to the Canal Commissioners, in relation to the proposed survey ; and although the survey from Connecticut River to the Hudson, is, by the resolves, to depend on the practicability of a canal from the Connecticut to Boston, yet we trust, it will not be considered premature, to present this subject to your consideration, inasmuch, as it may have some bearing, in determining the most suitable route, from Boston to the Connecticut.

At the meeting, holden on the sixth inst. a respectable committee was appointed, to make an examination of a route, from Adams to Deerfield River, and the meeting was adjourned to the thirteenth inst. at which time, the committee made a report, which accompanies this communication. It will appear from this examination and report, that Hoosack, or Green mountain, may be crossed, a few miles north of Adams, without much apparent difficulty. It is believed, that a sufficient quantity of water can be easily brought to

the summit level, from the northwest branch of Deerfield River, and from several ponds in the vicinity ; and that large reservoirs of water may be easily secured here.

The source of the north branch of the Hoosack River, is on the summit level, and the north west branch of Deerfield River, runs, in its course, within about 100 rods of the summit level ; and the Hoosack River, it is believed, is the only stream that rises in the county of Berkshire, and empties itself into the Hudson, unless it be a very inconsiderable one, quite at the southwest corner of the county.

From the information furnished by the committee, and the facts within the knowledge of the meeting, no doubt was entertained, but that this will be found the most eligible route, for a canal, from Connecticut River to the Hudson.

The undersigned, were directed to communicate these proceedings to the Canal Commissioners, and respectfully to solicit their attention to this route ; and to assure them, that whenever it shall be found convenient to make the proposed survey and examination, we shall be ready to exhibit to them, a more detailed statement of the proposed route ; and such further information, as may contribute to the accomplishment of this great object.

With much respect,

Your most ob't serv'ts,

DANIEL NOBLE,
WM. E. BRAYTON,
J. Q. ROBINSON,
CHARLES A. DEWEY,
NATHAN PUTNAM,
Berkshire Committee.

Hon. NATHAN WILLIS,
" E. HOYT,
" H. A. S. DEARBORN,
Canal Commissioners.

REPORT

Of the exploring Committee, referred to in the above communication.

The Committee, to whom was assigned the duty, of exploring the land and streams between the head waters of the north branch of the Hoosack, and the north west branch of Deerfield River, and also the ponds of that vicinity, with a view to ascertain whether, in their opinion, a canal could be made, over the Green Mountain, have attended to that duty, and ask leave to report:

That they considered the principal object would be to ascertain, whether a sufficient quantity of water could be conducted to the summit level; which they commenced at the summit, and levelled through, to the branch of Deerfield River, being about one mile. They found, that the water in said river, below the outlet of several ponds in the vicinity, may be conducted to the summit level; the high ground, at this place, is a ridge of land, about forty rods wide, and appears to be free from stone; this, probably, may be lowered very considerably; it is now about one hundred feet higher than Finney's flat, so called, which is a large tract of level land, eighty rods north, through which the Deerfield branch passes.

There are several ponds, from one to three miles distant, whose banks are so situated, that dams might be constructed, at a moderate expense, converting them into reservoirs, which ponds, altogether, would flow 100, or 150 acres, with a head of twelve feet. The ground, on the summit level, is favourable for the construction of a reservoir.

The Reedsborough Pond, is also in the vicinity; it is on high land, and supposed to cover three hundred acres; it has an outlet, on which there are a grist and saw mills.

The committee, believing there is sufficient water, exclusive of this pond, did not visit it; it is, however, the opinion of several gentlemen, acquainted with the pond, and adjacent ground, that the outlet can be conducted to the summit level, if necessary; the committee, are therefore unanimous, in the opinion, that there is sufficient water, to feed and support a canal, through said route; all which is submitted.

JEREMIAH COLGRAVE,
WM. E. BRAYTON,
BENJAMIN SIBLEY,
WM. WATERMAN,
THOMAS A. BRAYTON.

North Adams, Berkshire County,
July 13, 1825.

The foregoing letter and report, were received by the Commissioners, on their arrival at Greenfield, and the Berkshire Committee was informed, that they should commence the examination of the proposed route, from the Connecticut to the Hudson, on the 20th of July.

NO. 2.

Letter to Professor C. Dewey, of Williams College.

BOSTON, AUG. 9, 1825.

Dear Sir,

DURING our reconnoisance of the route of a canal, from Connecticut River, to the Hudson, we expressed, to the gentlemen in Adams, and to C. A. DEWEY, Esq. of Williamstown, a wish, that you should ascertain the elevation of Hoosack Mountain, above the Deerfield River, at the Great Bend, near where the turnpike road begins to cross the mountain; and also above Hoosack River, in Adams; and the distance, on a horizontal line, of one river from the other;

that in the event of the mountain being tunnelled, the length of it may be known; likewise, the height of the mountain, above the Hudson, at Troy, or tide waters.

If you can find leisure, to perform this duty, you will confer a great favour upon the Commissioners, as it will not be in the power of Col. BALDWIN, the engineer, to do it, this year, as he has to survey two routes, for canals, from Boston to the Connecticut.

I know I am asking a great favour, but, from your love of science, and disposition to advance the best interests of your country, I hope you will be able, and willing, to undertake the labour, and furnish me with the results of your admeasurements, in the course of the summer.

With sincere esteem,

I tender friendly salutations,

H. A. S. DEARBORN,

For Canal Commissioners.

Professor CHESTER DEWEY,

Of Williams College.

NO. 3.

Letter to William E. Brayton, Esq. of Adams.

BOSTON, AUGUST 10, 1825.

Dear Sir,

I wrote to Professor Dewey, yesterday, and requested him to ascertain the elevation of Hoosack Mountain, above the Deerfield and Hoosack Rivers, and above the Hudson, at Troy. I should like that he would, also, ascertain the height of the summit level, in Reedsborough, which I will thank you to name to him.

I have, this day, written to the Hon. Daniel Noble, desiring him, and the gentlemen of the committee, of which he

is chairman, to communicate such information, in relation to the projected canal, from the Connecticut to the Hudson, as it may be in their power to obtain. I informed him of the liberal offer which was made by the public spirited gentlemen of Adams, and of the neighbouring towns, in Vermont, to cause surveys to be made, of the summit level, and of the ponds and streams, which might be made use of, to supply the canal with water.

I confidently anticipate the result of your researches, during the summer, and shall be most grateful for any information, which you can communicate, that may tend to enable us to judge of the practicability, and importance of a canal from Boston, to the Hudson River; particularly, so far as relates to the county of Berkshire.

Very respectfully,

Your most ob't serv't,

H. A. S. DEARBORN.

Wm. E. Brayton, Esq.

Of Adams.

NO. 4.

Letter from William E. Brayton, Esq.

North Adams, August 29, 1825.

Sir,

I received, with pleasure, your communication of the 10th inst. relative to the contemplated canal, from Boston, to the Hudson River.

We have examined the ponds and ground, in the vicinity of the summit level, in Reedsborough, a plan of the same being enclosed, which is as perfect as our limited means would admit of making.

It is calculated, by gentlemen of intelligence, that there

would be a full supply of water, naturally running, in what is called the west branch of the Deerfield, to supply the locks, eight months in the year. The object is, to make up the deficiency. This must be done, by raising the ponds, with dams, and converting them into reservoirs; or, by taking the *main branch*, of the Deerfield, across the town of Searsburg, to the *west branch*, which we find can be done. This fact we did not know, when the Commissioners were here. We also find the ground, around most of the ponds, very favourable for the construction of reservoirs.

On the whole, there can be no doubt, but that the quantity of water, in the vicinity of the summit level, in Reedsborough, is amply sufficient for the supply of the canal, on that route.

Professor Dewey has agreed to be here this day, in order to commence taking the heights of the mountains, &c. The result of Mr. Dewey's observations will be forwarded to you, without delay. Mr. Noble will write you, and probably make some remarks, on the importance of a canal through this section of the country.

With sentiments of respect,

I am yours, &c.

WM. E. BRAYTON.

H. A. S. Dearborn, Esq.

NO. 5.

Letter to William E. Brayton, Esq.

Boston, August 31, 1825.

Dear Sir,

This morning I received your interesting communication, of the 29th inst. and the manuscript map of the country, in the vicinity of the Hoosack, or Green Mountain summit level.

The information, which you state, the Hon. Daniel Noble, chairman of the Berkshire Committee, intends to transmit, will be very acceptable, as will the result of Professor Dewey's admeasurements.

The Canal Commissioners will meet tomorrow, when the commendable efforts of the public spirited gentlemen of Adams, Williamstown, and of the borders of Vermont, will be made known, to the other members of the Board. In the mean time, permit me to tender my grateful acknowledgements, for your zealous efforts to furnish us with information, which it was not possible to obtain, in any other manner, during the present season.

Respectfully,

Your most ob't serv't,

H. A. S. DEARBORN,

Wm. E. Brayton, Esq.
Of Adams.

NO. 6.

Letter to Hon. Daniel Noble, of Williamstown.

Boston, Aug. 10, 1825.

Sir,

The Commissioners regretted that you were absent, when they passed through Adams and Williamstown; but the gentlemen of Adams, and of the neighbouring towns, in Vermont, kindly aided us, in the exploration of the Hoosack Mountain region, and promised to make farther researches.

I wrote to Professor C. Dewey, yesterday, requesting him to ascertain the elevation of Hoosack Mountain above the Deerfield River, at the Great Bend, near where the turnpike begins to cross the mountain; also above the Hoosack Riv-

er, in Adams, and of the Hudson, at Troy; likewise, the length of a tunnel, through the base of the mountain.

I shall be happy to receive, on behalf of the Commissioners, the result of the survey, which the gentlemen in Adams, and of the towns in Vermont, adjoining, or near the Massachusetts north boundary line, so liberally proposed to make, on or near the summit level, and of the ponds and streams in Stamford, Reedsborough and Woodford, which may be used to supply the canal with water.

As I am satisfied of the practicability, and sanguine in the belief, that a canal will be cut from the Connecticut River to the Hudson, through the vallies of Deerfield and Hoosack Rivers, as well as from Boston Harbour to the former river, and, at not a very distant period, it is important, that all the information, which it is possible to obtain, should be communicated, during the summer, to enable the Commissioners to make up a report, before the meeting of the Legislature; and knowing the deep interest that is felt in your section of the State, in relation to the grand project of connecting the Erie Canal with Boston Harbour, I entertain the fullest confidence, that the gentlemen of your committee, will cheerfully lend their co-operation, in the procurement of facts, to illustrate the proposed route.

A sketch of the Hoosack, from the sources of the northern and southern branches, to their confluence, at Adams, and thence through Williamstown, and the corner of Pownal, in Vermont, with the streams that fall into it, particularly the Green River, is desirable; also a statement of the probable quantity and kinds of products, which would pass on the Canal, either to Boston or the Hudson River.

Presuming that a canal can be made, from Pittsfield, down the basin of the southern branch of the Hoosack, to the main canal in Adams, any information, in your power to collect and transmit, as to the practicability, or utility of such a

side cut; its length, and the descent between Pittsfield and Adams, will be very acceptable.

With great respect,

Your most ob't serv't,

H. A. S. DEARBORN.

Hon. D. Noble,

Of Williamstown.

NO. 7.

Williamstown, Nov. 15, 1825.

Mr. Dearborn,

Sir—I duly received your letter of the 10th of August, ult. in relation to the contemplated canal, from Boston to Connecticut River, and from thence to the Hudson. Various circumstances have prevented an earlier reply. An apology is, however, due from me, for suffering your letter to remain so long unanswered. I was exceedingly sorry that I was from home, when the Canal Commissioners passed through this section of the country, as it would have been my duty, and my pleasure, to have given them every aid in my power, in the prosecution of the objects of their commission. The gentlemen in this county, and particularly the Committee of Inquiry, who are associates with me, and who have paid some attention to the subject, are fully convinced of the *practicability* of a canal from the Hoosack, across the mountain, to the Deerfield, and thence to Connecticut River.

We presume your own inspection, as well as the statements and plans, already forwarded by the Committee, will have satisfied you, that a full supply of water, may, without much expense, be got upon the summit level. Professor Dewey has taken the height of the mountain, from the Hoo-

sack, in Adams, to the summit level, which he makes, about 870 feet; he is not certain that this is perfectly acccurate, as the barometer he used on the occasion, was not in good order. However, we suppose, that it is not far from accurate. Mr. Dewey supposes, that the elevation from the Deerfield, at the *Great Bend*, to the summit level, is somewhat less. The length of a *tunnel*, through the mountain, it is believed, would be about four miles. The height of the summit level, above the Hoosack, we confess, is greater than we anticipated, but no obstacle arises from this source, calculated to weaken our faith in the practicability of the measure. From Adams, to the Hudson, your own observation has undoubtedly convinced you, that the Hoosack, with its auxiliary streams, would supply sufficient water for a canal, with but little fall. I have great doubts, whether it would be practicable to have a *side cut* from Pittsfield, down the south branch of the Hoosack, to Adams. There might be one, perhaps, ten or twelve miles, as far as Cheshire—but we think not further. As I have before remarked, no doubts will be entertained, by those who have attentively examined the subject, of the practicability of this *grand water communication*, between the Hudson and Connecticut Rivers, by means of the Deerfield and Hoosack. The only question involved in difficulty, is, whether the benefits to be derived from the measure, will warrant the expense. The discussion of this question, leads to an answer to the enquiries in your letter, relative to what would be probably transported on the canal, either to Boston or New York. It is difficult to answer this question satisfactorily. It is true, no doubt, that the very existence of a canal, would, of itself, give an impulse to business, which would furnish articles of transportation, not now thought of, and perhaps not in existence. It may be remarked, that this grand opening, between the "Mediterraneans of America," and the capital of New Eng-

land, would excite a powerful competition between New York and Boston, and thereby produce better markets.

Within the natural influence of the canal, in the counties of Berkshire and Franklin, and in the region of country north, in the State of Vermont, the following articles would be transported, either to Boston or New York, according to the state of the respective markets, viz :—Large quantities of butter and cheese, pork, beef, potash, lime, marble, ground bark, for tanning, large quantities of timber and lumber of various sorts, and white sand for the manufacture of glass. It may be added, that Boston would stand an equal chance of having many articles of produce from the West, transported thither, in preference to New York. It will be continually borne in mind by Massachusetts, and particularly by Boston, that the *inland navigation* will be the means of opening a market for the sale of goods, in regions very far to the west of it. Every gentleman, in contemplating this subject, cannot but be forcibly struck, with the immense importance of this great opening, in a national point of view, when he considers, that in a time of war, there would be a perfectly safe communication from the Atlantic, at Boston, to the Lakes, and thence to New Orleans. Whether the citizens of Massachusetts, are sufficiently awake to the importance of this subject, to ensure its speedy completion, may be a doubt; but that it will be eventually accomplished, seems almost certain, when we reflect how great is the present impulse, in regard to internal improvement, and what immense advantages would result from this measure.

I am, with much respect,

Your ob't serv't,

DANIEL NOBLE.

NO. 8.

Letter to George Tibbits, Esq. of Troy, N. Y.

Boston, Aug. 12, 1825.

Dear Sir,

When I had the pleasure of seeing you, with the other Commissioners and Engineer of this State, you generously offered to explore the valley of the Hoosack River, and the country between that river and a line from near Hoosack Four Corners, to Troy, for the purpose of ascertaining the most practicable route for a canal, to a point on the Hudson, near the junction of the Erie and Champlain Canals.

As it is important, that the route should be as direct as possible, from the Massachusetts line to Troy, you will confer a great favour upon us by transmitting the result of your reconnoisance, and particularly, of what you deem a possible route, through a valley and plain, extending nearly east, through Pittston, to a ridge, near the left bank of the Hoosack River, and west of the village of Hoosack Four Corners; also of the valley, which extends from the new bridge, through the country to Troy; and the elevation of the ridge, at the eastern end of the first named valley and plain, above the Hoosack River, at a place, where the river can be conveniently tapped, in the vicinity of the mills, in Pownal; or any other more favourable place, from whence a level can be kept up, the greatest height, to pass the ridge.

If you can furnish us with a map of Hoosack River, from Adams, and of the country south and west of it, to the latitude of Troy, it will be most acceptable.

I am induced to make this request, from the presump-

tion, that from the manuscript map which you exhibited, the large map of the State, and your intimate knowledge of the topography of that rich section of New York, one could be easily compiled; and, if required, you shall be refunded the expense.

It is to be regretted that we have not funds to defray the expense of an actual survey, of the whole route of a canal, from the Connecticut to Hudson's River, and therefore must, for the present, rely, chiefly, upon public-spirited individuals, for most of the information, on which a report can be made, to the Legislature of this State, as to the practicability and importance of such a canal.

You were so kind as to tender us permission, to make requisitions upon your large fund of intelligence, on this interesting subject, and have no doubt of your cordial disposition to meet our expectations.

There will, most indubitably, be many individuals, in this and the State of New York, who may consider a canal from Boston to the Hudson, as either impracticable or inexpedient: but I am sanguine in the belief, that there are no physical impediments, and that the period is not distant, when the execution of this grand project, will be imperiously demanded by the people; for not only the citizens of the states, through which the canal will pass, but of the whole Union, will, ere long, perceive the benefits which will accrue from the extension of an inland navigation, from Boston to New Orleans. A canal being made to the Connecticut, from this city, and that already commenced, from the Ohio to Lake Erie, completed, it is not to be presumed, that the comparatively short distance of seventy five miles, from the Connecticut, to the junction of the Erie and Champlain Canals with Hudson's River, will long remain untraversed by a canal, to complete this long line of interior communication,

between Massachusetts Bay, and the Gulf of Mexico, as well as with the extensive regions bordering upon the great lakes, the upper Missisippi, and the Missouri.

With the highest respect,

Your most ob't serv't,

H. A. S. DEARBORN.

GEORGE TIBBITS, Esq.
Troy, State of New York.

NO. 9.

Letter from George Tibbits, Esq. of Troy, N. Y.

TROY, AUG. 17, 1825.

Dear Sir,

Your favour of the 12th inst. came to hand last evening. I shall attend to its suggestions, immediately, and inform you of the result.

It will be impracticable to take levels, at the present; but I shall, before long, send you such a map of the routes, as I can get made, from the original surveys of the land, with my belief, from a view, of the rise of all of them.

I will write you again soon, and remain,

Respectfully, your friend.

G. TIBBITS.

H. A. S. DEARBORN,
Canal Commissioner.

NO. 10.

Letter from George Tibbits, Esq. of Troy, N. Y.

TROY, AUG. 31, 1825.

Gentlemen,

A protracted illness of Mrs. Tibbits, has prevented me from getting forward investigations, in regard to a canal, from

Boston to the Hudson, as fast as I could have wished. I have, however, looked very carefully at the two places, suggested for turning out of the valley of the Hoosack, and would now speak of them, more fully, was it not, that I am not, as yet, able to forward to you a map of the country, without which, you would get but imperfect impressions, from whatever I should say on the subject. I am satisfied, however, that a turn westerly, from the Hoosack Four Corners, will be attended with fewer difficulties, than at the Valley bridge, lower down the river, or any other. There can be no doubt of the practicability of the route, from Adams, down the valley of the Hoosack, to the Champlain Canal, at Still Water, about eighteen miles northerly, from the junction of the Champlain and Erie Canals, and making the route, about that much longer, than from the Four Corners, by the way of Troy. If this was the only objection, the shorter route might be dispensed with, if found to be most expensive. But, as I stated to you, when here, the shorter route from the *Four Corners*, to Troy, would inspire feelings, much more friendly to the project, and take in interests, that would very much facilitate its progress.

I am attempting to make up, from old surveys, a map, which will shew the country and water courses, from Williamstown, to the discharge of the Hoosack, into the Hudson, at Still Water, and southerly to Troy, and the junction of the Erie Canal with that of Champlain and the Hudson, and with it to send you such further information as I may acquire.

A canal from Boston to the Hudson, must prove of incalculable benefit to the country through which it passes, and greatly advance the general wealth of the Union.

A word as to *Ways and Means*, for making this canal. I apprehend, that neither Massachusetts nor New York, are to be relied upon, for doing it at the expense of the States.

Joint-Stock Companies will not do it. Congress will not make canals *directly*. They will never be able to agree upon the particular canal to be made first, and in the great number wanted, all of them will get the go-by. But the strong anxiety which pervades the Union, for making canals, will, I think, result in appropriations, by Congress, to the several States, proportioned to the population of each State, upon condition that the money shall be applied, by the States, respectively, in making canals within the State, in such places as Congress may and shall determine upon. If Congress should adopt this plan, the several States would, each, make such additions as they could, and altogether, I think, result in getting up a powerful competition among the States, to excel in this kind of improvement, and greatly forward the public welfare.

If the proportions of such appropriations, falling to Massachusetts and New York, were made upon condition, that they should make a canal, each to the line of its state, in a manner to meet on the line, the canal would be made, I think, very promptly.

There will be a powerful opposition, particularly in this State, against the interference of Congress in any other way than this mode ; and as an individual opinion, I think it will prove a waste of time to talk of any other. I throw before you, these undigested ideas, presuming that no harm can result from talking about ways and means, feelings and opinions.

My neighbour, Mr. R. P. Heart, will hand you this, and confer with you further upon these subjects.

I am, respectfully,

Your ob't serv't,

GEORGE TIBBITS.

H. A. S. Dearborn, Esq.

And the Canal Commissioners of Massachusetts.

NO. 11.

Letter from George Tibbits, Esq. of Troy, N. Y.

TROY, OCTOBER 18, 1825.

To the Massachusetts Canal Commissioners.

GENTLEMEN—No other conveyance offering, I send you, by the mail, a map, compiled, for the most part, from former actual surveys of the country, through which the contemplated Boston Canal must pass. It will shew the courses and distances of the principal streams, the Hudson, the Hoosack, Tamhenick and Paestenkill, accurately; the others will be found to be nearly, as laid down; the levels are mere estimates, from personal view. The rise from the Hudson, at Troy, to Clow's mills, near the Drowned Lands, is estimated at 350 feet; from this place to Eldrid's tavern, about fourteen miles, a level may be continued, without digging, or any great difficulty, and probably some fifty rods further, to the easterly margin of the interval, and foot of the hill, marked on the map, "Range of Highlands." The range of highlands is estimated, in the highest part, at seventy five feet above the level of the canal. It may be about a mile, ascending and descending gradually again, to the level of the canal, near the place marked, "Shulter's," and rendering a tunnel, for some part, on all this distance, necessary.

The foregoing long level, is estimated to be something higher, say forty or fifty feet, than a level brought from Brown's mill pond, in Pownal. It may prove to be less; by some pretty good judges, it is put at less.

From Clow's mills to Troy, the Paestenkill runs, every where, swift, and nearly the whole distance, on a slate rock bottom. A canal may, without difficulty, be carried along its margin, for the most part, on a loam soil.

The flat called the *Drowned Lands*, was, in its natural state, one continued, and almost impervious swamp, entirely level, and from a quarter, to a mile broad. It is now reclaimed, ditched, drained, and first rate meadows. Its course is from northeast to southwest, and bordered on the southeast by a mountain, covered with hemlock, spruce, beech and maple,—very much resembling the Green Mountains, and on which, the ponds, marked on the map, are situated, which may be greatly enlarged by dams, at the outlets.

This range of mountains continues its course northeasterly, forming the bluffs, which you see southwesterly, from the Four Corners, in Hoosack. Easterly of this range, and the valley of the Little Hoosack, lies another range of mountains, having the valley of the Little Hoosack on the west, and the valley of the Hoosack, through Pownal and Williamstown, on the east; easterly of Williamstown, lies another mountain, called Saddle Mountain; the Hoosack River and valley, turns the north end of this mountain, and passes up along the west side of Green Mountain, through Adams, Cheshire, &c. to its source.

It will prove impracticable to make a canal through these mountains, or to turn them, or to get through them farther north. I understood you to say, that there would be no difficulty in getting up the valley of Deerfield River, to the mountain, which divides it from the Hoosack, at Adams; and it is certainly practicable, to get down the Hoosack to the Hudson, which latter river you will cross about a mile above the mouth of the Hoosack, where the Hudson is narrow, deep and still; at the mouth of the Hoosack, the Hudson is very rapid, with high, rocky banks, on the west shore. Or turning off, from the valley of the Hoosack, follow the track, marked on the map, up to the junction of the Champlain and Erie Canals, at West Troy. The former route is certainly practicable, and the latter probably is. I entertain

a strong confidence, that a level may be continued from Clow's Mills to Eldrid's tavern, over ground which it will be very easy to make a canal,—much of it interval, or on the margin of interval land. And as to water, the Paestenkill may be turned into it, by a feeder, which will prove a productive part of the canal, for navigation. Water may be reserved in the ponds, to be let in, when wanted. The latter course, which will bring you directly to the junction of the Erie and Champlain Canals, will, moreover, give to the canal, the aid and influence of a respectable section of the country, which may prove essentially serviceable in its progress.

The range of *high land*, marked on the map, is only the highest part of a deep valley, called "*Shingle Hollow*," having the mountain, which I have described, on the south, and another, not as high, on the north, which continues, nearly to the mouth of the Hoosack, gradually declining, as it approaches towards the Hudson.

At the place called the "*Valley Bridge*," which you requested me to examine, the hill, on the south, is from 60 to 75 above the Hoosack River If this difficulty should be overcome, you would be again driven into the Hudson, not far from the mouth of the Hoosack; I therefore consider, no other course practicable, but the one laid down on the map, or to follow the Hoosack, to its junction with the Hudson. And as to the Adams Mountain, it must not keep the good people of New York and Massachusetts apart; it should be dug through, cost more or less; the sooner it is undertaken, the better.

Yours, &c.

GEORGE TIBBITS.

H. A. S. Dearborn, Esq.

And the Massachusetts Canal Commissioners.

NO. 12.

Letter to George Tibbits, Esq. of Troy, N. Y.

BOSTON, OCT. 26, 1825.

Dear Sir,

Your very interesting, and valuable communications, of the 31st of August, and the 10th and 18th inst. with the excellent map, which you were so kind as to compile, of the valley of the Hoosack, and the country between that river, the Hudson, and the southern bounds of Troy, have been received; and I tender the sincere thanks of the Commissioners, for the prompt and liberal contributions, of intelligence, which you have furnished, in relation to the practicability and expediency of constructing a canal, from Boston to the Hudson.

We have caused a survey to be made, of the valley of Deerfield River, to the top of the Hoosack Mountain. From its base, the fall of the river, to the Connecticut, is 611 feet, and the ground favourable for excavation, with no serious obstacles. The mountain rises, 1429 feet above the bed of Deerfield River, which is conclusive against locking over it; but by a tunnel between only four and five miles in length, this great difficulty will be removed; and to me, that is not such an achievement, as should, for a moment, excite doubt, or delay the commencement of so grand an undertaking, as the connexion of the Erie and Champlain Canals, with Boston Harbour.

Col. Baldwin, our Engineer, has surveyed the route from the mouth of Miller's River, across the summit level, in Ashburnham, to Fitchburg, and is now, descending east, to this city.

When we shall have made our report to the Legislature, you shall be furnished with a copy.

The suggestions you have made, as to the *Ways and Means*, are entitled to grave consideration, and we are much indebted to you, for them.

With great respect,
And unfeigned gratitude,
Your most ob't serv't,
H. A. S. DEARBORN.

G. TIBBITS, Esq.
Troy, New York.

NO. 13.

Letter to His Excellency De Witt Clinton, Governor of New York.

BOSTON, AUGUST 17, 1825.

Sir,

The Canal Commissioners, of this State, having made a reconnoisance of the route of a canal, from Boston Harbour to the mouth of Miller's River, opposite Gill, on Connecticut River, and being satisfied of its practicability, extended their explorations, in conformity to their instructions, to the Hudson.

We ascended the valley of Deerfield River, to the Hoosack Mountain, and crossing it, into the town of Adams, descended, from thence, the basin of Hoosack River, to near its mouth. This route was also considered practicable, but expensive, as there must be a tunnel, of from four to five miles in length, through Hoosack Mountain; for, although there is a sufficient quantity of water in Reedsborough, Woodford and Stamford, in Vermont, to supply a lockage over the mountain, about eight miles north of the Massachu-

setts boundary line, still, the distance being increased eighteen miles, and the elevation being great, probably five or six hundred feet, it is conclusive, that a tunnel is the most eligible mode of passing the crown summit level, between the Connecticut and Hudson Rivers.

Anticipating the pleasure of meeting you in Albany, we addressed a letter to you, from Greenfield, but on our arrival, we regretted to learn, that you had not returned from the West.

George Tibbits, and R. P. Heart, Esqrs. called upon us in Troy, and observed, that the citizens of that city, felt a deep interest, in the project of a canal, from the Hudson to Boston, as we found was the case, in all the towns through which we passed, between that river, and the Connecticut.

While in Albany, we waited upon Judge Spencer, Mr. James, and the Hon. M. Van Buren, and called at the residence of the Hon. Stephen Van Ransellaer, but he, unfortunately, was absent. The other gentlemen expressed a belief, that you would cheerfully co-operate, as would the Legislature of New York, in all such measures, as were best calculated for opening this important line of internal navigation.

It is unnecessary to present to you, for no one knows better, the advantages which would inevitably accrue to the States of New York and Massachusetts, and, in fact, to a large portion of the Union, from an extension of the Erie and Champlain Canals to Boston. That it will be ultimately executed, I am confident, and trust the period is not distant.

From these considerations, I have been induced to take the liberty of requesting, that you would be so kind, as to communicate your views, upon this very interesting subject; and such information as may tend to illustrate it, which, from your experience, in the construction of works of this Herculean character, the mass of intelligence you possess,

and the conspicuous efforts you have made, for more than fifteen years, to extend the intercourse between various portions of the United States, by the means of canals, cannot fail to be most instructive and useful.

Since our return to Boston, surveys have been commenced, by an able engineer, of two routes for canals, from this city to Connecticut River, which will be completed, in about four months; and we regret, that it will not be in our power to extend a survey to the Hudson, this season. Such intelligence, therefore, as it may be in your power to transmit, both particular and general, will be gratefully received.

When we were at Troy, Mr. Tibbits liberally offered to make some researches, for ascertaining whether a canal could not be made, direct to Troy, from Hoosack Four Corners, which he believed was practicable; and I have, within a few days, requested him, to forward the result of his explorations; and to furnish many other facts, which it is desirable to possess.

With the highest respect,
I have the honour to be,
Your most ob't serv't,

H. A. S. DEARBORN.
For the Commissioners.

His Excellency DE WITT CLINTON,
Governor of New York.

NO. 14.

Letter from His Excellency De Witt Clinton.

ALBANY, SEPT. 26, 1825.

Gentlemen,

I have received two communications from you, on the subject of a canal, from Boston Harbour to Troy, on the Hudson River; I regret, that my absence from this city, at the

period of your visit, prevented me from having an interview with you.

I am happy to perceive the disposition manifested by your State, to cultivate the great interests of internal improvement; and I assure you, that any assistance that I can give, any aid that I can render, officially, or individually, shall be entirely at your service.

It appears to me, that the most advisable course to pursue, in the first stages of such undertakings, has been adopted by you. Surveys and explorations of the country, examinations of the waters, and ascertainments of the levels, must be the first objects of notice.

The difficult parts of a route, which generally proceed from the interposition of mountains, or the scarcity of water, ought to be examined, most thoroughly; and after these objects have been attained, then one of the ablest engineers, that can be found, ought to be selected, with a view to a final decision on the course that ought to be adopted; taking into view, distance, expense, certainty of execution, and general accommodation.

As I have no personal knowledge of the localities of the country, I am not able to offer any suggestions in that respect. A long tunnel ought, if possible, to be avoided, in consequence of the great expense, the long time of excavation, and the inconvenience in navigation.

I am persuaded, that the Legislature of our State will afford you all proper facilities, in favour of your laudable undertaking; and considering, as I do, the multiplication of markets, and the facilitation of communication, as highly conducive to the general prosperity, I have no hesitation in assuring you of my cordial co-operation.

I have the honour to be, very respectfully,

Your most ob't serv't,

DE WITT CLINTON.

To the Canal Commissioners of Massachusetts.

NO. 15.

Letter from Franklin Ripley, Esq. of Greenfield.

GREENFIELD, AUG. 19, 1825.

Gen. Henry A. S. Dearborn,

DEAR SIR—I address you, at this time, to remove an impression, that may have been made upon you, that I have been negligent, in obtaining for you certain information, which you requested, relating to the number of boats, &c. that pass and repass, annually, the locks and canal, in Montague.

The toll-gatherer resides, at this time, seven miles from the falls, where he keeps his books, and is very unwilling to make any disclosures, which might facilitate the opening a canal from Connecticut River to the capital.

I have taken considerable pains, and have not yet been able to find him, where his books are, and have not obtained the particulars you wished. I am enabled, however, to state to you, that under all the disadvantages, that have hitherto attended the canal, their annual receipts have averaged $11,000.

You will permit me to suggest to you, that there is, about ten miles north of us, an inexhaustible quarry of slate stone. They were formerly wrought to a considerable extent, but the difficulty of transportation, has induced the owners, to circumscribe their operations. Were the proposed canal to be made, they would almost supply the Boston market with that article.

I am, very respectfully,

FRANKLIN RIPLEY.

NO. 16.

Letter to Franklin Ripley, Esq. of Greenfield.

BOSTON, AUG. 22, 1825.

Dear Sir,

Please to accept my sincere thanks for your kind communication of the 19th inst.

I trust, that the Directors of the Montague Canal, do not indulge the narrow sentiments, which their agent appears, unfortunately, to entertain, but will cheerfully afford the desired information. It should be borne in mind, by those gentlemen, that the progress of internal improvements, of the grand, and highly important character, which are now in progress, throughout the Union, are not to be checked by the want of courtesy, on the part of incorporations of minor establishments, or the adverse interests of a few individuals. What the public good demands, consistent with the constitution and laws of the General and State Governments, will be achieved, when the people require it, and it is the duty, as well as the policy, of all persons, to cheerfully co-operate in such measures, as will tend to extend the intercourse, both by roads and canals, between all parts of the country. If there should occur instances of individual injury, reparation will indubitably be made, but the anticipation of such evils is not to be received as impassable barriers to opening a common county road, much less to the location of the route of a vast canal, which is to traverse the whole state, and ultimately extend to the Hudson, near the junction of the Erie and Champlain Canals. Our views must be as enlarged as the object to be attained, and all little impediments left, as everlasting stumbling blocks, to those, who *habitually turn aside*, if a *reed* crosses their path.

I hope you will still be able to collect all the facts, which it is desirable to obtain ; but if you do not, I am confident it will not be owing to a relaxation of your zealous efforts.

Is the iron mine you name, the one recently purchased by Mr. Allen, up Deerfield River, or that named by Mr. Hitchcock, in Montague, near Miller's River ? Will you inform me of the extent of each, and the per cent. of iron the ore yields ; also of the copper mine, near the great falls, on the right bank of the river ; the more particular your statement, the better.

With the highest respect,
I tender friendly salutations,
H. A. S. DEARBORN.

FRANLIN RIPLEY, Esq.
Greenfield, Massachusetts.

NO. 17 .

Letter to Franklin Ripley, Esq. of Greenfield.

BOSTON, SEPT. 1, 1825.

Dear Sir,

On looking over your letter again, this evening, I perceive I mistook a portion of it, in the first hasty perusal, and that it was "*slate*," and not "*iron*," which you mentioned, as being within ten miles of Greenfield. I hasten to apologise for my error, and will thank you to inform me of the precise location, and the extent of the quarry ; its distance from the river—the quality of the slates it yields—the price per 100 square feet—where they have generally been sent for sale, and the expense of transportation.

The information, as to the iron and copper mines, which I requested, will also be very acceptable.

I hope you will excuse the freedom I take, in making these requisitions upon your kindness, and accept assurances of my most respectful consideration.

H. A. S. DEARBORN.

Franklin Ripley, Esq.
Greenfield, Massachusetts.

NO. 18.

Letter from Franklin Ripley, Esq.

Greenfield, Sept. 23, 1825.

Sir,

It would afford me much pleasure, to be able to describe to you the iron and the copper mines, to which you allude, in your letter. It would require a greater acquaintance, both with chemistry and mineralogy, as well as with facts, than I possess.

The iron mine is situated about eighteen miles from this place, a little south of west. The owners, and others acquainted, say that the ore is inexhaustible, and of good quality. It is contemplated, to form a company, for the investment of capital sufficient to work the mine, on an extensive scale, and great confidence is manifested, that the result will be profitable.

Of the copper mine to which you allude, I know but little. It has never been wrought, and but little examined. Chymists and geologists, in their excursions, have come in contact with it, and have thought it promised much. The Rev. Mr. Hitchcock, of Conway, would delight to give you a scientific description of it, and could do it from personal acquaintance with the mine.

The quarry of slate stone, to which I took the liberty of calling your attention, in a former letter, and about which

you inquire, is situated in the town of Guilford, in the State of Vermont, about twelve, or perhaps fifteen miles from this place, north; its extent, not short of half a mile, probably over, and I should apprehend, less than that, distant from Connecticut River. The owners say its quality is equal to any offered in Boston or New York; to both of which cities they carried large quantities, during our commercial restrictions; since which, the business, owing to the diminution of price, has much decreased. Foreign slates have, in a great measure, driven them from the market, because they have had no conveyance by water, that could be depended on. The price we gave them for the slate to cover our bank, delivered here, was six dollars per square, that is, six dollars, for as many slate as would cover ten feet square, the same that 1000 shingles are estimated to cover. This was three years ago. The price now, would, probably be less. As I remaked above, they formerly answered large orders from Boston and New York. Of late, they supply, I conclude, but little more than the demand in the country. The freight could not be less than three dollars per ton, to Hartford. I should hardly dare to estimate how much would be the weight of one square.

I hope you will unreservedly address me, if there be any thing, within my reach, about which you wish to inquire,—and believe me, with great consideration,

Respectfully yours,

FRANKLIN RIPLEY.

Gen. H. A. S. Dearborn.

NO. 20.

Request of several gentleman of Rutland, Holden, Paxton, Oakham, &c. to examine a canal route through those towns.

TO THE CANAL COMMISSIONERS, FOR THE COMMONWEALTH OF MASSACHUSETTS.

THE subscribers, inhabitants of the towns of Rutland, Holden, Paxton, Oakham, Hardwick, New Braintree and Ware, respectfully represent:—That they have explored and examined, as far as their means will allow, the several ponds in Rutland, Paxton, Holden and Oakham, which would be required, as sources of water, for the supply of a canal from Boston to Springfield. They have ascertained, to their satisfaction, that the supply of water is ample, and, in their opinion, the routes down the valley, through which the Ware River flows westerly, to Palmer, and down the valley, through which a branch of the Nashua River flows, easterly, to Lancaster, are practicable, and may be used for a canal, with a moderate expense; and they would respectfully request, if consistent with the arrangements of the Commissioners, that their engineer may be instructed to ascertain the altitude of said ponds, and survey the routes described; and, for the purpose of facilitating his labours, we hold ourselves pledged, to aid him, by previous examinations of the country, and to afford him such other assistance as he may require.

THOMAS A. DEXTER, SAMUEL BILLING,
SAMUEL DAMAN, EBEN. ESTABROOK,
JOSEPH KING, JAMES ESTABROOK, Jr.
MERRILL DAVIS, ROBERT MUNROE,

JOHN P. MAYNARD,
JAMES ROBINSON,
SIMON P. STRATTON,
SAMUEL GATES,
LAWSON SAVAGE,
PAUL DAVIS, Jr.
THOMAS J. DAVIS,
WM. MEAD,
WM. ROBINSON,
DAVID DAVIS,
BUTLER GOODRICH,
DENNIS DAVIS,
JONES ESTABROOK,
LEMUEL DAVIS.

NO. 21.

Letter to the gentlemen of Rutland, &c.

BOSTON, SEPT. 6, 1825.

Gentlemen,

YOUR communication of the 2d inst. was received, after the Commissioners had separated; but Mr. Wilder, having previously informed me of the surveys you had made, and of your wishes, that Mr. Baldwin should run a trial level over the projected route, I communicated the intelligence to the other members of the Board.

When we made the reconnoisance of Ware River, and of the ponds in Rutland and Paxton, we were perfectly satisfied, that it was practicable to make a canal from the Connecticut, up the vallies of the Chickapee and Ware Rivers, and over the summit level, in Rutland and Paxton, to the southern branch of the Nashua, and down its basin, to a point, where it would intersect the northern route of a canal, which had been previously explored.

In conformity to these views, it is contemplated, to cause the necessary surveys to be made by the engineer, if there should be sufficient time, and funds, to enable us to effect it. At all events, it is probable, the height of the summit level, on the route you have explored, will be ascertained; and as we shall, on the tenth of October, commence the reconnoi-

sance of other proposed routes, from the ponds in Ashburnham, north of that which passes through Bolton, it is possible, we may avail of your kind tender of services, and pass up the valley of the Nashua, through Boylston, Holden, Paxton and Rutland. You shall be informed of our determination in due season.

Very respectfully,

Your most ob't serv't,

H. A. S. DEARBORN.

THOMAS A. DEXTER, *and others.*

NO. 22.

Letter to Hon. Stephen Van Ransellaer, President of the Board of Canal Commissioners, for New York.

BOSTON, SEP. 26, 1825.

Dear Sir,

As the Board of Canal Commissioners of this State, desire information, on several subjects, which it is in your power to communicate, permit me to request, that you would be so kind, as to answer the following queries.

1. The depth of the Erie Canal, and its width at top and bottom.

2. The expenses of excavation, on an average, per cubic yard, where there was no blasting.

3. The whole number of feet of lockage, from Albany to Buffalo.

4. The size of the locks, generally, and their average cost.

5. What did the hammered stone, for locks, cost, per cubic, or superficial foot.

6. Which is the preferable mode of excavating a canal,—by contract, or labourers hired by the day, or month, under superintendants.

8. What was the expense, per cubic yard, in excavating the deep cut through the ledge, at the mountain ridge, near Lockport,—the depth, width and length of the canal, through that ridge.

9. What was the cost, per cubic yard, in cutting through the ledge, near the Cohoes falls.

10. Including all expenses, what has been the cost of the canal, per mile.

11. What is the size of the boats, generally used, for the transportation of merchandize, the products of agriculture, and of the forest: the cost of the best and of the cheapest kind, that are used, and of those generally used; their draft of water, when fully laden; the number of persons employed to navigate them; the number of tons they transport; the number of horses by which the boats are drawn; their daily progress; do they stop during the night?

12. What number of days, taking the average of the years since any portion of the canal has been navigable, has the ice been an obstruction to the passage of boats.

13. What number of boats have usually passed the canal, from Utica to Albany.

14. What number of boats, is it estimated, will pass the canal, when open from Buffalo to Albany.

15. The number of tons of merchandize, and products of the country, that have passed in a year, and what number is it estimated will pass the next year.

16. What is the difference of expense, in the transportation of a ton, from Buffalo to Albany, on the canal and in a waggon.

17. The number of tons of produce, which were annually

brought to Albany, before any portion of the canal was made, and of goods, sent from Albany, into the country.

With the highest respect,

Your most ob't serv't,

H. A. S. DEARBORN.

Hon. STEPHEN VAN RANSELLAER,
President of the Board of Canal Commissioners,
of the State of New York.

NO. 23.

Letter from Gen. Stephen Van Ransallaer.

ALBANY, OCT. 12, 1825.

Dear Sir,

I have the honour to enclose the answers to queries, in your letter, respecting the Erie Canal, from recollection, not having my documents before me; they are, however, substantially correct. I have also forwarded you our last report, which may not have met your eye.

Our Board are very much engaged, at present,—and on the 26th of this month, boats will pass to *Albany* from *Buffalo*, distance 362 miles.

With respect, yours,

S. VAN RANSELLAER.

Gen. H. A. S. DEARBORN.

Answers to the Queries.

1. The depth of water, in the Erie Canal, is four feet; the height of the banks, in all places, not less than six feet, from bottom of canal; the width of canal, at bottom, twenty eight feet; at the surface of the water, forty feet.

2. The average expense of excavation, where there has been no rock to remove, has been probably 12 1-2 cents, per cubic yard.

3. The whole number of feet of lockage, from the Hudson to lake Erie is 688 ; and the number of locks, 83.

4. The size of the locks is such as to admit of boats 14 feet in width, and 85 feet in length.

5. The locks are built of sand and lime stone. The gray limestone has been preferred.

6. The quarrying and drawing the stone, has cost from one dollar to three dollars per perch, for the face of the locks ; and the cutting of the face of the beds, about thirty cents, the superficial foot, measuring the face only.

7. The cheapest method of constructing a canal, is by contract, to be done under the inspection of competent engineers.

8. The expense of excavating the rock, at the mountain ridge, per cubic yard, has been one dollar and seventy five cents ; the depth of cutting has ranged from 18 to 31 feet ; the width, at the top, and down to the towing path, is 40 feet, the remainder is 30 feet. The length of rock cutting, is about three miles.

9. The cost of excavating the rock, near the Cohoes, may have been 75 cents per cubic yard.

10. Exclusive of interest on the canal loans, the cost of the Erie Canal will average about $20,000 per mile. Average cost of locks, about $1000 dollars per foot.

11. The boats employed on the Erie Canal, are, in general, of 30 or 40 tons burthen ; the Durham boat is the kind most preferred ; they cost from $250 to $300, and if well covered and finished, with convenient cabins, $600 ; they are usually drawn by two horses, and when relays of horses are furnished, as is often the case, they proceed during the night, as well as the day ; a boy for a driver, and two hands on board the boat, is sufficient to navigate it ; but more than this number is often employed.

12. A particular estimate, made by Commissioners. See report. Extract from report. "The annual period of navi-

" gation, at present, is about 220 days; but if the same " changes of climate are produced in our country, and these " changes appear to be rapidly progressing, by the cutting " down of the forests, as have been produced in France, " Germany, Italy, and other countries, by the same process, " our annual seasons of navigation will, ultimately, be ex- " tended to 250 or 275 days."

[Thus, the number of days, during which the canal is obstructed by ice, is 145, but may be reduced to 90, and perhaps less.]

13. Answered in last annual report of Commissioners. Extract from the report.

" The number of boats which have passed on the canal, " below the junction, [of the Erie and Champlain Canals] " has been equal to an average of forty per day, through the " season; between the junction and Utica, on the Erie Ca- " nal, twenty four per day, [which are 5,280 per year] and " between Utica and Rochester, sixteen per day, including " packet boats, of which four run daily."

[From the above facts, it appears, that 8,800 boats pass to and from Albany, during the year; and if the half of that number are taken as descending boats, and average a cargo each, of 40 tons, 176,000 tons of the products of the country come to Albany; and, as the Commissioners, in the report alluded to, estimate the returning boats to take a cargo of only 8 tons, on an average, there are sent from Albany, annually, 35,200 tons of merchandize, which would require, to bring in from, and carry back into the country, 211,000 waggons, each laden with one ton weight.]

14. An estimate made; see report.

[From the statement in the report, it appears, that the canal is capable of passing 39,600 boats, from Buffalo to Albany, which will transport, down, 1,584,000 tons of products, and carry back, 316,800 tons of merchandize.]

15. See last annual report.

[By the statement, from the Collector's office, at West Troy, contained in the report, it appears, that 128,452 tons, passed east, and 28,994 tons, north and west, making 157,446 tons, which passed, east, north and west, in a season, viz. 1824,—of which, descending east, 16,330 tons were flour, 17,057 tons wood, 52,884 tons boards and plank, 7,625 tons of wheat, 5,784 tons of pot ashes, 3,469 tons of provisions, 6,615 tons of stones, and 4,304 tons of timber; no other article amounted to 2,000 tons.]

16. The difference of expense in transportation, from Albany to Buffalo, by land, or on the canal, about as thirty to one.

NO. 24.

Letter to Rev. E. Hitchcock, Conway, Mass.

BOSTON, SEPT. 1, 1825.

Rev. Sir,

WILL you do me the favour, of transmitting, an account of the lead, copper, iron and other mines, which are in the vicinity of Miller's, Deerfield and Hoosack Rivers, and on the route of the canal, from Ashburnham, through Lancaster, Bolton, &c. to Boston; their location, extent, the quality of the ores, and whether any of them are of a character to warrant their being wrought; of the quarries of granite, lime, marble, slate, free and other stones, which may be useful as building materials, or for other purposes; of the beds of clay, which may be used in the manufactory of the finer kinds of earthen ware, or porcelain; of sand, for glass; and of marl, fuller's earth, and plaister of Paris.

In deciding upon the expediency of making a canal, from Boston to Hudson River, it is important to know, what natural products, of the kinds above named, or any others,

exist near the proposed route, that either are, or may be rendered subservient to the extension of the arts, supply domestic consumption, or increase the amount of our foreign exports.

From your profound knowledge of mineralogy, and the numerous researches you have made, in those interesting regions, I have presumed to ask this additional contribution to that fund of intelligence, which you have already, so meritoriously increased; and that, while you have so honourably laboured to enlighten the paths of science, you will cheerfully give your aid, to facilitate the labours of practical industry; as the glorious efforts for the application of science to the mechanical and useful arts, are the *chief objects*, and highly valuable consequences, of *modern* philosophical inquiries.

With sincere esteem,
And great respect,
Your most ob't serv't,

H. A. S. DEARBORN.

Rev. M. Hitchcock,
Conway, Massachusetts.

NO. 25.

Letter from Professor Hitchcock.

New Haven, Dec. 1, 1825.

Dear Sir,

I received your first letter, just at the time when, from a wretched state of health, I was about abandoning my station at Conway, and when, for some months, the mere writing of a letter, was more than I wished to undertake, and this is the reason I have not replied to it sooner. Even now, I feel unable to give you as full an answer as you might wish.

And really, Sir, I do not suppose I can afford you much information on the subject you mention. Most that I know about it, is contained in my sketch of the geology, &c. of the Connecticut, in the 6th and 7th vols. of the American Journal of Science; and I shall take the liberty to refer you to particular parts of that piece, for more precise information.

In regard to the canal route, east of Miller's River, I know but little, except, that on it, or near it, may be found granite of almost every description, nearly the whole distance. Between Athol, and its mouth, Miller's River crosses the exterior range of porphyritic granite, extending from New Hampshire, probably across the whole of Massachusetts. I do not know that it has ever been used for building, but I should suppose some varieties would be quite beautiful.

1. In Montague, not far from the mouth of Miller's River, occur quarries of gneiss, a most valuable stone, for the basement of dwellings, and other parts of brick edifices especially. It occurs in large, thick laminæ, and requires but little working.

2. A great variety of sand stone and slates, occur along the banks of Connecticut River, between the mouth of Miller's River and Turner's falls, some of which would do well for flagging stones. *See Journal Sci. vol.* 6, *p.* 61 *to* 83.

3. Inexhaustible quarries of excellent roofing slate, exist in Guilford, Dummerstown, &c. in Vermont, and not far from the banks of the Connecticut. *Journal, vol.* 6, *p.* 35 *to* 37.

4. Large quantities of the old red sand stone, are found in Gill, Greenfield and Deerfield, and quarries are opened. It affords a good building stone.

5. Immense quantities of green-stone occur about the mouth of Deerfield River; a rock much used for buildings, in Hartford and New Haven.

6. Extensive beds of granular quartz, exist in Vernon,

Vermont, eight or ten miles above the mouth of Miller's River, and not far from the Connecticut. It has been used for making glass, but I do not know to what extent, or with what success.

7. Large quantities of micaceous iron ore, that has never been wrought, exist within half a mile of the mouth of Miller's River. Beds of the same mineral occur, also, and have been wrought in Bernardstown, six or eight miles from Turner's falls, and also in Hawley, three miles from the banks of Deerfield River. *See Journal, vol.* 6, *p.* 207 *and* 208.

8. At least two veins of green carbonate of copper, and pyritous copper occur a few rods below Turner's falls, in Greenfield. They have not been explored; but I see no reason why they may not be productive. *Journal, vol.* 6, *p.* 207.

9. Mines, and veins of lead, with some copper and zinc, exist in Leverett, South Hampton, Whately, Williamsburg, and all of them within a few miles of the Connecticut, and only twenty or thirty miles below the mouth of Miller's River. There can be little doubt, but these localities, and those on the Missouri, will, ere long, supply the whole United States with this metal. I am acquainted with nearly a dozen veins, in the above named towns, few of which have been explored. Seventy or eighty thousand dollars have been expended in digging an *adit* to the South Hampton mine, and when they strike the vein, we may anticipate that they will supply the market, cheaper than any other locality, east of the Missisippi. *Journal, vol.* 7, *p.* 201 *to* 205.

10. A vein of quartz, several feet wide, occurs in Conway, six or eight miles from Deerfield River, containing the oxide of manganese. It does not appear very productive at the surface, but might prove so, if explored, as mines usually grow richer in descending.

11. A peculiar talco-chloritic rock occurs in Plainfield and Hadley, six or eight miles from Deerfield River, containing a curious configuration of black hornblende. It admits of a polish, and to my taste, would make a very pretty ornamental stone.

12. Lime stone, that makes good quick lime, exists, and is burnt, in Whitingsham, Vt. not far from Deerfield River, but I have not visited the spot. I know of no other lime stone in the vicinity, east of Hoosack Mountain, that can be employed as a cement or as marble.

13. I do not despair of the discovery of coal, along the Connecticut; and I know of no place more likely to contain it, than between the mouth of Miller's River and Turner's falls. Certainly, so far as I can judge, from specimens, all the rocks of the coal measures exist there.

I will not attempt any account of the interesting and valuable rocks and minerals that exist along the Hoosack River, as I am but imperfectly acquainted with them, and Professor C. Dewey, of Williams College, will be able to furnish you all the information you desire concerning them.

I trust, Sir, that the state of my health will be an apology for the scantiness and imperfection of this communication. If it affords you the least assistance, in the important object you have under consideration, I shall be gratified.

Very respectfully, yours, &c.

EDWARD HITCHCOCK.

Gen. H. A. S. Dearborn.

NO. 26.

Letter to His Excellency C. P. Van Ness, Governor of Vermont.

BOSTON, OCT. 20, 1825.

Sir,

In behalf of the Canal Commissioners of this State, for ascertaining the practicability of making a canal from Boston Harbour to Connecticut River, and from thence to the Hudson, near the junction of the Erie Canal with that River, permit me to request, that you would be so kind as to communicate your opinion of the effect which the completion of such a canal would have, upon the State of Vermont, and the public sentiment, as far as you have ascertained it, in relation to this important project, particularly, as it relates to that portion of the route, from Boston to Connecticut River.

We are satisfied, that it is practicable to make a canal from Boston to the Ashburnham summit level, between the tide waters and the Connecticut, and thence through the vallies of Miller's, Deerfield and Hoosack Rivers, to Troy; and if this route should ultimately be adopted, a portion of the canal would pass through Pownall, and thus intersect the proposed canal, from the southwestern part of Vermont, near the New Bridge, so called, across the Hoosack River.

Vermont being bounded on its whole eastern line, by the Connecticut, a canal, which shall unite that river with Boston Harbour and the Hudson, cannot fail to be highly advantageous to the citizens of a large portion of the State.

Having been informed, that it is contemplated to make one or more canals from Lakes Champlain and Memphre-

magog to Connecticut River, you will much oblige me, by furnishing copies of such reports as have been made, on the several proposed routes, if any have been presented to the Executive or Legislature of Vermont; and if not, such information as you may possess, in relation thereto; and especially, as to the lines of the various routes, their extent, and the apparent practicability, and the probable expediency of their execution.

With sentiments of the highest respect,

Your most ob't serv't,

H. A. S. DEARBORN.

His Excellency, C. P. Van Ness,
Governor of the State of Vermont.

NO. 27.

Letter from His Excellency C. P. Van Ness, Governor of Vermont.

Burlington, Dec. 12, 1825.

Dear Sir,

Your letter, of the 3d inst. has been received, as was also that to which you allude, as having been previously written.

I intended to have answered your first letter, at the close of the late session of our Legislature, but was, unexpectedly, obliged then, to go to New York, from which place I have just returned.

I have now requested the clerk of our General Assembly, to forward to you copies of the reports, which were made during the session, on the subject of canals.

There is no doubt, that a strong interest is felt in this State, with respect to the improvement of the navigation of Connecticut River, and consequently, every inland water

communication connected with it, but more particularly, that contemplated from your city to the river.

I take the liberty to enclose a copy of that part of my late communication to our Legislature, which relates to this subject.

I have the honor to be, &c.

C. P. VAN NESS.

H. A. S. Dearborn, Esq.

NO. 28.

Letter to His Excellency D. L. Morrill, Governor of New-Hampshire.

Boston, Oct. 24, 1825.

Sir,

In behalf of the Commissioners of this State, for ascertaining the practicability of making a canal from Boston Harbour to Connecticut River, and from thence to the Hudson, near the junction of the Erie and Champlain Canals, with that river, permit me to request, that you would be so kind as to communicate your views, and what appears to be the opinion of the citizens of New Hampshire, in relation to this important project.

As the Connecticut River is the western boundary of New Hampshire, a canal, which should connect it with this harbour, either from the mouth of Miller's or the Chickapee River, could not fail, it is presumed, of being highly beneficial to a large portion of the State, as it would offer a cheap, certain, easy and expeditious mode of transporting the products of the forest, of agriculture and of mechanical industry, to an extensive maratime emporium, where they could be exchanged for those foreign or domestic articles,

which may be required for local consumption, on such favourable terms, as a large market auspiciously offers.

Several surveys of canal routes having been made, during the past summer, through various parts of New Hampshire, and for connecting Lake Memphramagog with the Connecticut River, in which a Commissioner of the State assisted, you will confer a special favour, by transmitting the reports of the gentlemen, who have been charged with those duties; and such other information, as may be deemed interesting, on the proposed improvements, for facilitating the internal intercourse of the States.

With the highest respect,

Your most ob't serv't,

H. A. S. DEARBORN.

His Excellency D. L. Morrill,

Governor of New Hampshire.

NO. 29.

Letter from His Excellency D. L. Morrill, Governor of New Hampshire.

Goffstown, N. H. Nov. 14, 1825.

Sir,

Your communication, in behalf of the Canal Commissioners, &c. has been received. In this, you ask my "views, and the opinion of the citizens of this State, in relation to this subject." My own opinion, respecting particular routes, is unsettled. My information, from surveys and estimates, has not been sufficient to justify a decision. On the subject, generally, I can observe, I have no doubt but a practicable route may be found, between the Merrimack and Connecticut; but which of the three, now in contemplation, is uncertain. This subject will probably be settled, by com-

missioners, appointed for that purpose. Col. Caragain, appointed to co-operate with Mr. Clinton, has made no report at present; when this shall be done, I will transmit the same to you without delay. I imagine, the citizens generally, feel quite a laudable interest, in the subject of internal improvement. This I infer, from the letters I have received from Col. Carrigain, while on the Connecticut, and exertions of the citizens, in the eastern section of the State, in procuring the surveys in that quarter, and in the region of the Winipiseagee—the report of their proceedings you have probably seen. I have no doubt, but a canal from the Merrimack to the Connecticut, to facilitate transportation to Boston, might be highly advantageous to this State and Massachusetts; but whether the advantages would be such, as to induce our citizens to embark in the enterprize, is uncertain.

I am, very respectfully,

Your ob't serv't,

DAVID LAWRENCE MORRILL

Gen. Dearborn.

NO. 30.

Letter to the Hon. James Barbour, Sec'y of War.

Boston, Oct. 2, 1825.

Dear Sir,

Having noticed in the newspapers, that Mr. Clinton, an engineer, in the service of the United States, had surveyed the route for a canal, from Connecticut River to Lake Memphramagog, the Canal Commissioners of this State, charged with the duty of ascertaining whether it is practicable to make a canal from Boston Harbour to Connecticut River, and from thence to the Hudson, will esteem it a great favour, if you will be so kind as to furnish them with a copy of his report.

If it is practicable to open a navigation with Lake Memphramagog and thence to the river St. Lawrence, it will be an additional and powerful inducement, to connect the Connecticut with *this harbour:* and from your distinguished efforts and patriotic zeal, to advance the best interests of the republic, we are confident, you will cheerfully afford us such information, as it may be in your power to communicate, which may tend to accelerate the advance of internal improvement.

With the highest respect,
I have the honour to be,
Your most ob't serv't,

H. A. S. DEARBORN.

Hon. JAMES BARBOUR,
Secretary of War, Washington City.

NO. 31.

Letter from Hon. James Barbour, Sec'y of War.

WASHINGTON, OCT. 27, 1825.

Dear Gen.

I have just received your letter of the 22d. I beg you to receive my thanks for the favourable sentiments you are kind enough to express, as to my zeal in promoting the internal improvements of our common country. My purpose is, to endeavour to justify them.

So soon as Mr. Clinton's report is made to this department, a copy thereof shall forthwith be transmitted you. Any information, in my possession, or any aid, in my power to give, in facilitating the object referred to, by you, will be most cheerfully rendered.

I beg you to be assured
Of my esteem and friendship.

JAMES BARBOUR.

H. A. S. DEARBORN, Esq.

NO. 32.

Letter to Gen. Ebenezer Thatcher.

BOSTON, AUG. 9, 1825.

Dear Sir,

UNDERSTANDING that you possess the plans and reports, made under the direction of your distinguished father, Gen. Knox, of the route of a canal from Boston Harbour to Connecticut River, I request, on behalf of the Board of Canal Commissioners of this State, that you would be so kind as to loan them to us, which, if you should be so good as to do, I will thank you to forward them to me.

Very respectfully,

Your most ob't serv't,

H. A. S. DEARBORN.

Gen. EBENEZER THATCHER,

Thomastown, Maine.

NO. 33.

Letter from Gen. Ebenezer Thatcher.

THOMASTOWN, AUG. 20, 1825.

Dear Sir,

I received yours of the 9th inst. requesting me, in behalf of the Canal Commissioners, to furnish you with a plan of the route, surveyed under the direction of Gen. Knox, with a view to connect your city with Connecticut River, by internal navigation.

We have the great plan through Worcester, which I will send by the first vessel to you, asking it as a favour, that you will see it receives no injury.

We have also plans of a more northerly route, through Lancaster, as far down as Bolton and Stow.

We have also the plan of the cut, from Barnstable to Buzzard's bay, taken during the administration of the late Governor Hancock,—all by John Hills, Esq.

I am, Sir, very respectfully,

Your ob't serv't,

EBENEZER THATCHER.

Gen. H. A. S. Dearborn.

NO. 34.

Letter to Gen. Ebenezer Thatcher.

Boston, Sept. 27, 1825.

Dear Gen.

The plan made by John Hills, Esq. for Gen. Henry Knox, of the southern route of a canal, from Connecticut River to Boston, which you were so kind as to transmit, has been received, for which we tender our most grateful acknowledgements.

You observe, that you have plans of a more northern route, which we are also anxious to see, and shall esteem it an additional favour, if you will be so good as to forward them, with the reports of the engineer, and such other papers as you may possess, illustrative thereof, or in relation to the practicability of making a canal on either route. You may rest assured, that the best possible care will be taken of them, and will please to excuse these requisitions upon your liberality; but, from the commendable zeal which your illustrious father-in-law constantly evinced, to extend the internal navigation of his country, and your known patriotic

feelings, we are confident you will cheerfully afford us all the aid in your power.

In behalf of the Canal Commissioners of Massachusetts,

I am, with great respect,

Your most ob't serv't,

H. A. S. DEARBORN,

Gen. EBENEZER THATCHER,

Thomastown, Maine.

NO. 35.

Letter from Gen. Ebenezer Thatcher.

THOMASTOWN, OCT. 11, 1825.

Sir,

YOUR communication of the 27th of September, has been received, and would have been answered sooner, but from a wish to discover some papers, in relation to the subject, which Mr. Hills, who I understand was an intelligent man, must have left with Gen. Knox, disclosing his views upon the subject of a canal, the obstacles and facilities which presented themselves, &c. I have devoted several days to the examination of the papers of Gen. Knox, without success, thus far, but I do not despair of finding something which may be useful.

I beg leave to assure you, that it will, undoubtedly, be a gratification to me, to contribute, in any degree, to so important and desirable an object, as the projected canal from Connecticut River to Boston.

Whether any of the plans we have on hand, will promote this object, I know not, but such as they are, they are certainly at your service. There do not appear to be any explanatory papers with them; although I cannot doubt, that such have and probably do exist, and which I hope to be able to discover.

It is very possible that I may have occasion to visit Boston, myself, in the course of a few days; if so, I will bring whatever I can find, with me; if not, I will send them by the first safe conveyance.

If they should be found useful, the Committee may, perhaps, be disposed to purchase them, and in this case, we shall be willing to part with them on reasonable terms.

I am, Sir, with much respect,

Your ob't serv't,

EBENEZER THATCHER.

Gen. H. A. S. Dearborn.

NO. 36.

Letter to Philo Dickinson, Esq. Paterson, N. J.

Boston, Nov. 26, 1825.

Dear Sir,

In behalf of the Canal Commissioners of this State, I request that you would do me the favour of answering the following questions.

1. What is the height of the summit level of the Morris Canal, from the Delaware to the Hudson?

2. If there is a tunnel on the line of canal, what is its length, breadth and height; the proposed mode of construction, and estimated expense per yard, rod or mile?

You will also much oblige me by transmitting such reports, as may have been made, by the commissioners and engineers, that have been printed.

I am aware that I have no claims upon your kindness, but trust you will excuse the freedom I have taken.

Very respectfully,
Your most ob't serv't,

H. A. S. DEARBORN.

P. Dickinson, Esq.
Paterson, N. J.

NO. 37.

Letter from Philo Dickinson, Esq.

Paterson, Nov. 25, 1825.

Dear Sir,

I this day received your letter, and with pleasure give you such information respecting the Morris Canal, as I have in my power.

The length of the canal, from the tide water of the Passaick River, to the Delaware River, opposite Easton, is seventy-six miles, and the summit level is 888 feet above the Passaick, and 756 feet above the Delaware, at Easton, making 1644 of lockage—the canal is 14 feet wide at bottom, 30 feet wide at surface, and 4 feet deep; the locks are to be 9 feet wide, 64 feet long, and 8 feet deep, calculated for boats of 25 tons burthen. The estimated expense of the canal, supposing the elevation to be overcome entirely by locks, is $1,148,103, as by the statement hereunto annexed. If the inclined planes are used, the expense is $864,263.

The locks are to be made with a lift of 8 feet each, requiring 206 locks, (unless the inclined planes are used,) and it will take a boat 44 hours and 45 minutes, to pass through the canal, allowing 7 1-2 minutes to pass each lock, and 10 more on the canal, at the rate of 4 miles an hour.

The Morris Canal is laid through a mountainous and rocky

country, and over a great elevation. It receives its supply of water from a large pond, at the summit level. The Company have contracts for the excavation and embankments of about two thirds of it, and their contracts have all been made much lower than the estimate. There is no tunnelling required, nor any extraordinary expense for deep cutting or large embankments; and I have no doubt but that it will be finished for less money than the amount estimated. They are now erecting an inclined plane at Rockaway, on the line of canal, which will be finished in a few weeks, if the season will permit. The plane is about 700 feet long, and overcomes an elevation of 60 feet. They are very anxious to complete it this fall, in order to test its utility, as it is but an experiment, but they have full confidence in it, and if it should answer their expectations, it will be a very important improvement. It will not cost more than half as much as locks, and will pass more boats, and in much shorter time, but cannot be made to advantage, unless there be an elevation, at least, of 40 or 50 feet at one place, to be overcome; and although I have not full confidence in the plan, I should think it advisable, for any company, who are about forming a canal, to wait the result of the experiment.

By the plan of the enclosed plane, it is calculated that a boat will pass through the Morris Canal in 28 hours and 33 minutes, instead of 44 hours 45 minutes, thereby saving 16 hours 12 minutes—which would be of vast importance. The foregoing estimates have received the sanctions of the most eminent engineers, and may be relied on as being correctly made, so far as the subject matter will permit. I understand that the expense of tunnelling is about equal to the expense of a cut of 35 feet deep.

The Commissioners made a report, some years ago, to our Legislature, and from the documents accompanying their report, I have obtained the foregoing information; but the

report is too voluminous to transmit by mail, and contains a great deal of matter, interesting only to those, who are interested in the canal and State.

The commissioners have executed their trust, and the canal is now in the hands of the company, and will probably be completed in about two years. Neither my brother nor myself have any interest in it, except as Jerseymen, and living on its line.

Estimate of cost of Morris Canal, with locks entire.

Excavation and embankment,		$230,184,00
Masonry for aqueducts and culverts,	42,287	
For 206 locks, *a* $400 a foot lift,	659,200	701,487,00
150 bridges, *a* $100 each,		15,000,00
76 miles of grubbing, *a* $200 a mile,		15,200,00
76 miles of fence, *a* $450, do.		36,480,00
Expense of engineer and superintendent, *a* 5 per cent.		49,917,55
Contingent expenses, *a* 10 per cent.		99,835,10
Total expense,		$1,148,103,65

Estimate upon plan of locks and inclined planes, upon the supposition that 1400 feet of the lockage were to be overcome by inclined planes, and 244 by common locks.

Excavation and embankment, (same,)	$230,184,00
Masonry of aqueducts and culverts, (same)	42,287,00
244 feet of locks, *a* $400 a foot,	97,600,00
1400 feet lift of inclined plane, *a* $200,	280,000,00
Bridges, (same)	15,000,00
Fences, (same)	36,480,00
Engineer and superintendence, *a* 5 per cent.	35,337,55

Contingent expenses, 10, per cent.	71,675,10
	809,063,65
Grubbing (same)	15,200,00
Total expense,	$824,263,65

If you wish any farther, or more particular information upon the subject, I will give it with pleasure, if in my power.

I am yours, respectfully,

PH. DICKINSON.

H. A. S. Dearborn, Esq.

NO. 38.

Letter from S. V. S. Wilder, Esq. Bolton.

Bolton, Dec. 10, 1825.

Dear Sir,

An absence to New York, has prevented a sooner reply to your esteemed favour of the 18th ult. which I found on my return here.

I now hasten to answer your several inquiries, as far as my information extends, with as much accnracy as the nature of the subject will admit, without a more thorough investigation.

The first mills above the turnpike road, on the south branch of the Nashua, are Carter's grist and saw mills, and clothier's works, and nail factory, in Lancaster.

On a tributary stream, half a mile from the Nashua, are two cotton factories, capital actually employed, $100,000. Three miles from Carter's mills, up the south branch of the Nashua, are Pitt's grist and saw mills, with a small spinning factory, and two miles from thence, up the river, are Sawyer's grist and saw mills, with clothier's works, and two miles

from thence, up the Nashua, is located the West Boylston factory—capital actually employed, $80,000. One mile from thence, up the river, is situated the upper factory, in West Boylston—capital about $50,000. Five miles from thence, on a tributary stream, in Holden, is a factory, the capital of which is to be $150,000. Six miles from thence, are Damond and Long Ponds, in Rutland—from thence to a factory in New Braintree, is eight miles, capital employed, about $30,000. From thence down Ware River, to Ware factory is eight miles, capital of which, when all is completed, will be $500,000—from thence to Palmer factory, ten miles—capital of which will not be less than $500,000—from thence to Ludlow factories, six miles, capital of which is $250,000—from thence to Springfield factory, five miles, capital of which will be upwards of $600,000, when all is completed.

I calculate there are six of the foregoing establishments that will eventually manufacture, on an average, say ten bales of cotton and wool per day. Now suppose there are 300 working days in the year, and 300 lbs. to each bag—the result is 18,000 bags of cotton and wool per year, weighing 5,400,000 lbs. ; now add the same weight in manufactured goods, and as much more for iron castings, and other materials connected with the manufactures, and supposing they were all to be transported from and to Boston, by a canal, and the toll would amount, at half the prize of land carriage, to upwards of 100,000 dollars per year ; but admitting that half of the foregoing materials were conveyed, (as they probably would be,) on Connecticut River, and the income to the canal, arising from these factories alone, would be at least $50,000 per year.

It has been almost impossible to ascertain the precise number of loaded teams that pass through Bolton, to and from Boston, in twenty-four hours, owing to the number that

pass in the night season; but those persons best informed, calculate, that on an average, during the year, (Sundays I am sorry to say, not excepted,) about forty wagons per day, carrying, on an average, about one ton each, which would make 14,600 tons per year, all of which come from or go to that region of country, on or near the route from hence to Greenfield. Now in case of a canal extending as a south fork or branch, from Lancaster to Springfield, you may safely calculate, as coming from that quarter, as much more, making, say, 29,200 tons; to which you may add, say as much more, 29,200 tons for articles, such as salted beef, pork, hay, lumber and wood, which are now too heavy and expensive to transport any considerable distance by land carriage, but would be sent to Boston by a canal, and you will have a total of 58,400 tons,—for the transport of which, by a canal, averaging the distance from Boston at fifty miles, and calculating the expense at half the price of land carriage, for that distance, say $6 per ton, and the tolls would amount to $350,400,00

To which add the transport for the factories on south fork, 50,000,00

$400,400,00

Now deduct for four months in the year, for the canal being closed, and admit the same proportion of weight to be transported by land, during these four months, say, 133,466,67

$266,933,33

Deduct for agents collecting tolls and repairs, say, 56,933,33

Leaves a nett income per year, of $210,000,00

Now admitting the main canal to Lancaster and the north

and south forks or branches, from thence to Greenfield and Springfield, to cost, when completed, $3,000,000, the result will give to the proprietors or stockholders, seven per cent. interest for their money.

You will perceive, Sir, the foregoing statement is predicated on the supposition of a south fork or branch of a canal from Lancaster to Springfield, and on a north fork from Lancaster to Greenfield; for I am convinced, that no one route to Connecticut River, will unite the suffrages of the whole State, and if these routes are practicable, you cannot submit, for the sanction of the Legislature, or the acceptance of stockholders, a more popular plan.

If the gentlemen Commissioners, and Engineer, are of opinion, that it is more practicable to unite the forks, at Littleton, and more expedient thus to make a circuitous route of eleven miles, at an additional expense of $220,000, rather than tunnel Bolton hill, then let it be done.

Respectfully, I have the honour to be, &c.

S. V. S. WILDER.

H. A. S. Dearborn, Esq.

NO. 39.

Letter from H. Hutchinson, Esq. Civil Engineer.

Providence, Dec. 22, 1825.

Dear Sir,

On my return, last evening, from New York, I received a letter from Col. John W. Lincoln, enclosing yours, of the 26th of November, requesting answers to the following queries.

1. What is the whole fall of Connecticut River?

2. The fall from the mouth of Miller's River to that of the Chickapee, and

3. The fall from the mouth of the Chickapee to tide water.

It gives me great pleasure to be able to communicate to you the required information.

The whole fall of Connecticut River, from Barnett, in Vermont, (the commencement of my survey,) to Hartford, Con. is 420 feet, and the distance, in the direction of the river, is 219 miles.

From Miller's River to the mouth of the Chickapee, the fall is 138 1-2 feet; and from thence to tide water is 31 1-2 feet.

Respectfully, your ob't serv't,

HOLMES HUTCHINSON.

H. A. S. Dearborn, Esq.

NEW YORK
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
BERKSHIRE Co
HAMPSHIRE Co
WORCESTER Co
Schaghticoke
Pittstown
Petersburgh
Troy
Lansingburg
Waterford
Hoosack
Hoosack Falls
Bennington
Woolford
Searsburgh
Wilmington
Whitingham
Readsborough
Stamford
Rowe
Clarksburgh
Williamstown
Adams
Florida
Charlemont
Fownal
Greenfield
Deerfield
Montague
Shelburne
Buckland
Gill
Leverett
Wendell
New Salem
Orange
Athol
Royalston
Winchendon
Templeton
Gardner
Ashburnham
Westminster
Connecticut River
Deerfield River
Hoosack River
Hudson River
Millers River

PLAN

of a Survey for a Canal from

BOSTON TO CONNECTICUT RIVER.

with a Sketch of a proposed Route to the

HUDSON.

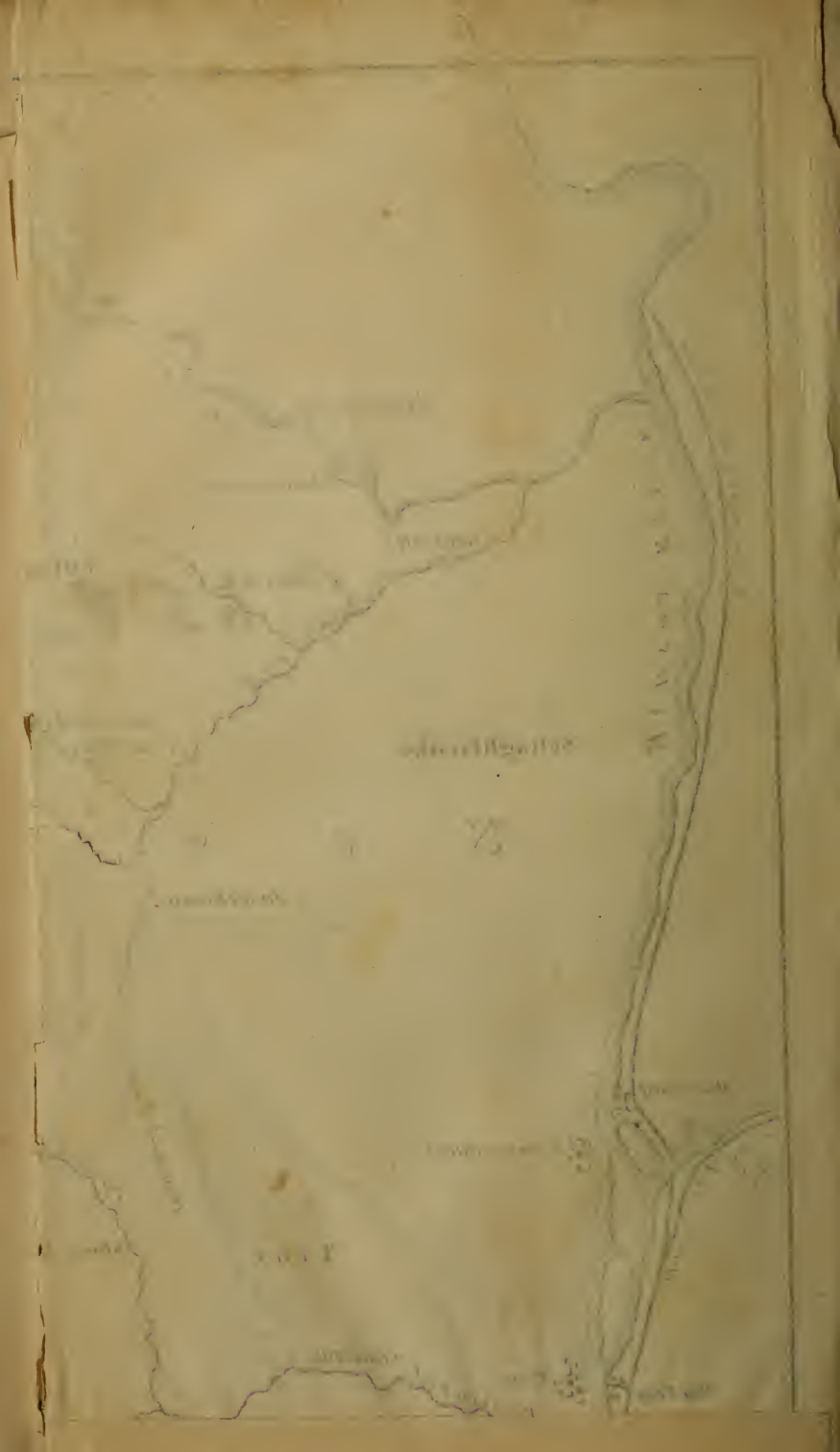
Made under the direction of the Commissioners

by L. Baldwin, Engineer.

1826.

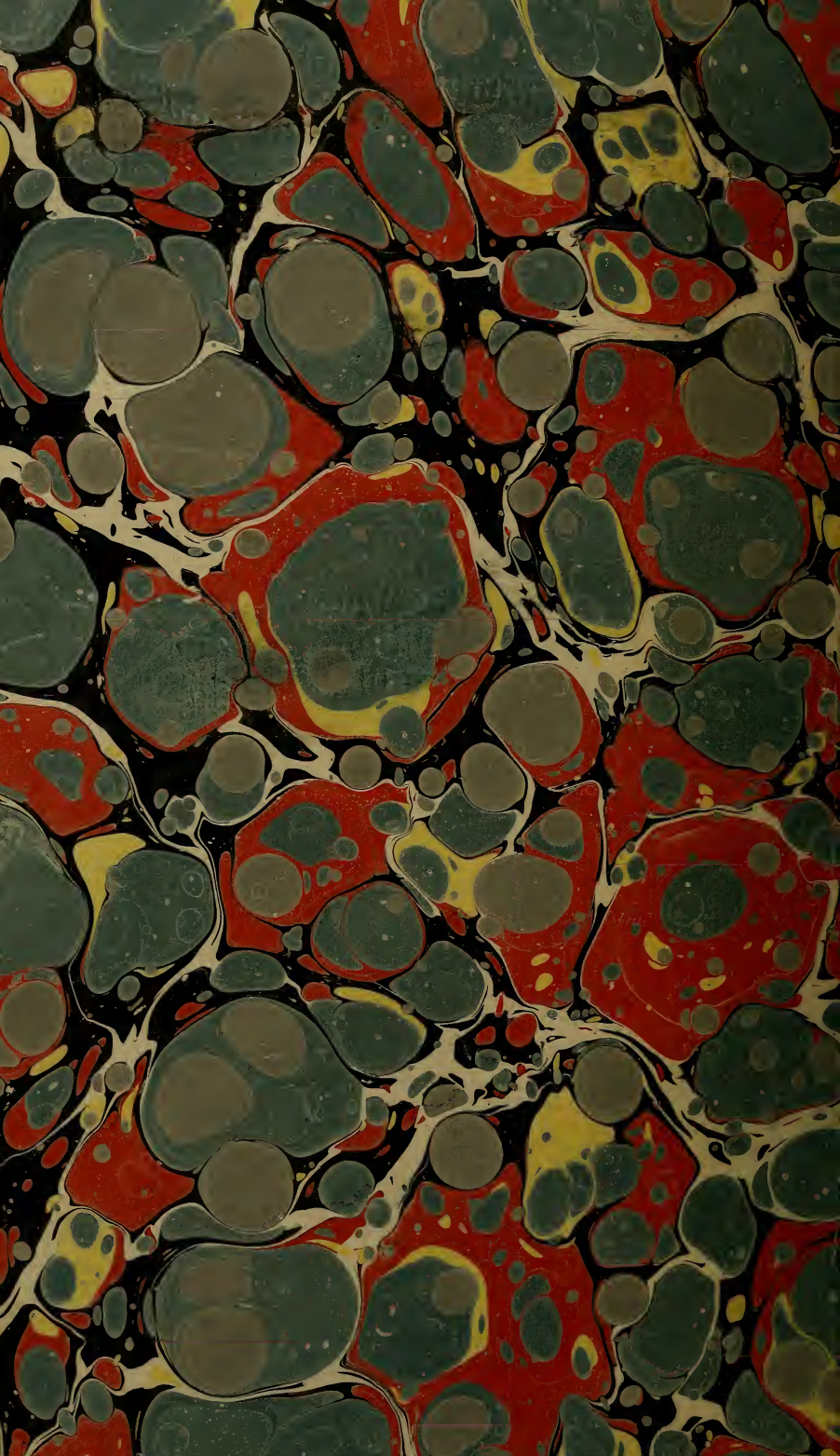
MIDDLESEX Co

SCALE 4 Miles to an Inch



Adams Library 1799.

Natural History
of the
Slug Worm
W. D. Peck Prof.

C 655

C. 65. 8